SCIENTIFIC AMERICAN

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NATURAL GAS IN KANSAS.

Since 1886 natural gas has been a commercial product in Kansas, where it has been found in numerous localities, although the total supply thus far obtained has not been great. Quite recently, however, oil and gas were discovered in the southeastern part of the State, and several companies obtained leases and began prospecting, the Palmer Oil and Gas Company, of Ohio, operating in the neighborhood of Iola, Kansas. In a well recently drilled near that place, the pressure of the flow of gas was so great that drilling operations had to be suspended, and, after getting the well under control, the managers arranged to drill a second well by operating the engine and drilling plant with the high pressure gas obtained from the first well. Our illustrations represent the scene of these operations.

The second well was started at a distance of sixteen hundred feet from the first one, a pipe carrying the high pressure gas from the first well to the engine, and, to counteract the effect of the extreme cold which would be caused by the expansion of the gas in passing through the engine, the gas in the delivery pipe is heated in a very simple manner before it reaches the engine. The delivery pipe is tapped to afford a flow of gas to a smaller pipe arranged beneath, about thirty feet long, in which holes are drilled at frequent intervals, and the lighted gas from these apertures raises the temperature of the gas delivered to the engine sufficiently to obviate any trouble from cold produced by its expansion in passing through the engine, although the gas is intensely cold as it issues from the exhaust. In the picture the gas is burning as it comes from the exhaust. Only a small part of the entire product of the well is thus used, but the simple manner in which a flow of gas which would otherwise go to waste is utilized is, we believe, quite novel.

A HIGH PRESSURE GAS WELL IN KANSAS.

ENGINE AND WELL DRILLING PLANT OPERATED BY HIGH PRESSURE NATURAL GAS.

THERE are 16,000 exiles in Siberia.

Naphtha Wool Scouring.

The naphtha is forced through and through the wool by means of a pump and all the natural oil or yelk is expurgated. It is said the naphtha does not injure the fiber of the wool, as alkali cleansing, but leaves the fleece in better condition than when cleansed by any other process. A further valuable feature of the new method is that after the grease is extracted from the wool it may be again extracted from the naphtha in a pure state, thereby becoming valuable as a medicinal agent or for a saponificator into the purest of soaps. It is claimed that a plant following this method scoured 300,000 pounds of wool, and had saved a product of 80,000 pounds in pure wool oil.

A Grafted Snake.

According to the San Francisco Chronicle, a Dr. G. A. Countryman, of Mallette, S. D., possesses a combination snake. It is half garter and half sand snake, and this peculiar combination was made possible by a surgical operation performed by the doctor. His attention was directed to snakes from observing that when a snake was killed its tail appears to live until the sun goes down, when life ceases. It is thought by many that this is owing to the nerves, but the doctor was somewhat skeptical on this point. Being a surgeon he dissected several, and made some interesting discoveries. He found that in both the sand and garter snakes the spinal column extended little more than half the length of the body. Knowing that it was possible to graft flesh, this led him to chloroform them and try splicing them, making the splice, of course, below the end of the spinal column.

He made four unsuccessful attempts, but succeeded in the fifth. The grafted snake he has now is apparently in good health and the joined parts are perfectly knitted together. Its body is of the sand snake and its tail is a garter snake's.

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"AS BROADLY AS POSSIBLE."

In a recent appeal case in the Patent Office, the examiner having refused to entertain the claims of the applicant, Assistant Commissioner of Patents Fisher overruled the examiner and in his decision said:

"It is the well settled policy of this office to allow inventors to claim their inventions as broadly as possible in view of the state of the art. At the same time the statute requires that the 'applicant shall particularly point out and distinctly claim the part, improvement, or combination which he claims as his invention or discovery.'"

This excellent doctrine should be loudly proclaimed and reiterated in every nook and corner of the Patent Office until it is made familiar and brought into practice by officials of every grade. It accords with the well known object for which the Patent Office was brought into existence, namely, to encourage, assist and reward the inventors and discoverers of improved arts and industries. There are still some people in the Patent Office who appear to labor under the mistaken notion that it is their duty to hinder the allowance of patents; whereas the Constitution expressly encourages the grant of patents. Officials are therefore in duty bound to assist and facilitate the inventor as much as possible, and never to obstruct or delay his patent applications.

J. TRAILL TAYLOR.

The death of this well known photographic journalist will cause widespread regret among his hosts of friends all over the world. His decease, quite unexpected and sudden, took place on the 8th instant in Florida, where he had gone on a short visit of rest and recreation.

Mr. Taylor was about sixty-four years of age, Scandinavian by birth, but reared in Scotland and was always taken for a Scotchman. His father was a watchmaker and taught him that trade in Edinburgh. At that time there was no trait in his character indicating literary talent. But the work of repairing watches furnished little recompense, and to eke out a living he learned shorthand and reported some court matters. He then became interested in photography and received an education as best he could in the study of optics and chemistry. He had also a yearning for the press and liked to write reports for publication. In connection with his old friend Dr. John Nicol he founded in the back shop of the watch store, in 1861, the Edinburgh Photographic Society and reported the meetings to the British Journal of Photography, published in London. He wrote other articles for the same journal.

His practical knowledge of and enthusiasm for photography were such that his writings greatly increased the standing and value of that publication. In 1864 he removed his residence to London and took the editorial chair and general management of the Journal, employing his friend Dr. Nicol to supply numerous leading articles. About 1880 he retired from the Journal for five or six years, came to the United States and was appointed chief editor of the Photographic Times, which was changed under his management from a monthly to a weekly journal. During this period he also contributed to the SCIENTIFIC AMERICAN. In 1885 he returned to London and resumed his position as chief editor of the British Journal. When in Edinburgh he was on terms of friendship with Fox Talbot, one of the early discoverers after Daguerre, and in 1861 submitted to the Scotland Photographic Society a lens, the first of the nature ever constructed, by which could be produced at the will of the operator either crisp, sharp definition or as much diffusion of focus (so called) as was desired. He was a prolific journalist and experimentalist. A large portion of the ninth edition of Hardwich's "Manual of Photographic Chemistry" was written by him. The well known annual the British Journal Almanac was created and edited by him and has come to be an authority in photographic matters. He was an honorary member of many photographic societies and at one time was president of the North London Photographic Society and of the Photographers' Benevolent Association. He also was one of the prime movers in the starting of the annual photographic convention of Great Britain.

It was his fortune to know all of the discoverers and inventors of the present modern dry plate process. Probably his knowledge of the many different processes and modifications of processes was the most extensive of any person living. In photographic journalism he was a pusher and at the same time conservative in his opinions.

He leaves a wife and two sons, one of whom is editor of the Magic Lantern Journal and Enlarger.

His genial face will be greatly missed by his many friends. To the knowledge he spread in regard to photography and photographic processes many, doubtless, to-day owe to him their means of livelihood.

ALL of the states, kingdoms, principalities, empires, etc., of Europe (except Russia) and all of the United States, including Alaska, could be placed side by side in Siberia.

DEFECTS OF "FIREPROOF" BUILDINGS.

A disastrous fire recently took place in the city of New York, at the corner of Broadway and Bleecker Street, the results of which are notable, as they included the destruction of a large building heretofore supposed to be fireproof. This structure—the Manhattan Savings Institution—an eight story affair—consisted of an iron frame or skeleton, filled in with masonry. The fire broke out on the opposite side of the street from the bank in a large brick building, filled with combustible goods. The intense heat of the conflagration cracked the glass windows of the opposite bank building and set fire to the wooden floors, desks, chairs and inflammable goods, soon after which the interior iron columns, girders, and iron beams suddenly fell and the structure was converted into ruins.

The question naturally arises why such a building, composed as it was of non-combustible materials, should so quickly go to destruction.

By the courtesy of Chief Bonner, of the New York Fire Department, we were enabled to inspect the ruins of the building and make a sketch, herewith presented, which will aid us in answering the inquiry.

In the Manhattan building the floors are carried upon 30 inch box girders (see sketch) 40 feet long and running the width of the building. The outer end bears upon heavy and substantial brick piers and the inner end upon cast iron columns, which are built into the north wall. These main girders are spaced about 24 feet apart and carry 15 inch I beams, which are spaced 4 feet center to center. Resting upon the bottom flanges of the I beams are 2 inch T irons, and the flanges of these last serve to carry the single layer of fireproof blocks or slabs, which are about 3 inches thick. Two thicknesses of dressed flooring are laid directly upon the top flanges of the I beams.

The fireproof blocks are approximately flush with the base of the I beams; but they do not, as they should, project under and cover them. The lower flange of these beams has no further protection than that afforded by the ceiling plaster. The fault of this construction consists in the fact that the whole of the lower half of the main girders has no protection against the heat of a fire. When the fierce flames struck the lower flange of these girders they stretched, and the whole girder with its load of I beams sagged down, pulling the brick pier with it. It was a natural and inevitable result; and it would happen in scores of buildings in which the main girders in like manner project below the ceiling line, and are without any fireproof covering.

Another serious fault and fatal economy is seen in the cheap nature of the brick protection. Instead of the solid brick arch, springing from the flanges of the I beams, and covered to the level of the flooring with sand or ashes, there is a single layer of thin slabs of brick, with an open air space of no less than 12 inches between them and the wood flooring above. This wide space would give all the air supply necessary to turn the wooden flooring into a sea of fire at short notice. Had the lower half of the main girders and the bottom of the joists been adequately protected, and had the space between flooring and fire brick been filled in with non-conducting material, in other words, had the work of fireproofing been thoroughly carried out, the Manhattan building, in all probability, would have been standing to-day practically intact.

In disposing the fireproof material upon a skeleton frame building, the first care should be to protect in the most thorough manner the columns and the main floor beams.

In these lofty buildings the cross-girders, such as this one shown in the sketch, have an important duty to perform besides that of carrying the particular floor of which they form a part. They are the ties which hold the main columns, upon which the superimposed building rests in place. The collapse of two or three such girders in the lower floor would pull the main columns out of plumb, and hurl the whole structure to the ground.

The ideal fireproof building should fulfill three conditions:

1. It should be proof against attack from without.
2. The skeleton frame, consisting of steel columns and horizontal girders, should be inclosed in some thoroughly fireproof material.
3. It should be able to localize a fire, and confine it to the particular floor upon which it originates.

In the case of the majority of buildings there is evidence of an attempt at fulfilling the third condition, a partial attempt at the second, and none whatever at the first.

The first condition can only be met by reducing the window space; building the walls with a facing of the very best fire brick; and furnishing every window with a plate or roller shutter of steel.

The second condition can be reached by walling in every column and every main girder with high class fire brick; leaving between the brick and the metal a space that shall be filled in with a preparation of asbestos, similar to that now used on steam piping or with some similar non-conducting material.

The third condition can be attained by building

fire brick floors with cement finish, abolishing all woodwork, and using metal window casings and sashes, providing each elevator landing with plate steel doors, and, lastly, placing on each floor a powerful water supply. Such a building would be costly, but it would be fireproof.

The Genius of Japanese Civilization.

Without losing a single ship or a single battle, Japan has broken down the power of China, made a new Korea, enlarged her own territory, and changed the whole political face of the East. Astonishing as this has seemed politically, it is much more astonishing psychologically; for it represents the result of a vast play of capacities with which the race had never been credited abroad, and capacities of a very high order. The psychologist knows that the so-called "adoption of western civilization" within a time of thirty years cannot mean the addition to the Japanese brain of any organs or powers previously absent from it. He knows that it cannot mean any sudden change in the mental or moral character of the race. Such changes are not made in a generation. Transmitted civilization works much more slowly, requiring even hundreds of years to produce certain permanent psychological results.

The adoption of western civilization was not nearly such an easy matter as unthinking persons imagined. And it is quite evident that the mental readjustments, effected at a cost which remains to be told, have given good results only along directions in which the race had always shown capacities of special kinds. Thus, the appliances of western industrial invention have worked admirably in Japanese hands—have produced excellent results in those crafts at which the nation had been skillful, in other and quainter ways, for ages. There has been no transformation—nothing more than the turning of old abilities into new and larger channels. The scientific professions tell the same story. For certain forms of science, such as medicine, surgery (there are no better surgeons in the world than the Japanese), chemistry, microscopy, the Japanese genius is naturally adapted; and in all these it has done work already heard of round the world. In war and statecraft it has shown wonderful power; but throughout their history the Japanese have been characterized by great military and political capacity. Nothing remarkable has been done, however, in directions foreign to the national genius. In the study, for example, of western music, western art, western literature, time would seem to have been simply wasted. These things make appeal extraordinary to emotional life with us; they make no such appeal to Japanese emotional life. Every serious thinker knows that emotional transformation of the individual through education is impossible.

Where are the outward material signs of that immense new force she has been showing both in productivity and in war? Nowhere! That which we miss in her emotional and intellectual life is missing also from her industrial and commercial life—largeness! The land remains what it was before; its face has scarcely been modified by all the changes of Meiji. You might journey two hundred miles through the interior of the country, looking in vain for large manifestations of the new civilization.

Generally speaking, we construct for endurance, the Japanese for impermanency. Few things for common use are made in Japan with a view to durability. The straw sandals worn out and replaced at each stage of a journey; the robe consisting of a few simple widths loosely stitched together for wearing, and unstitched again for washing; the fresh chopsticks served to each new guest at a hotel; the light shoji frames serving at once for windows and walls, and repapered twice a year; the mattings renewed every autumn—all these are but random illustrations of countless small things in daily life that illustrate the national contentment with impermanency. The Japanese population represents a medium whose particles are in perpetual circulation. The man of the people in America cannot compare, as a traveler, with the man of the people in Japan. The Japanese who travels most is not the man who needs railways or steamers to carry him.

With us, the common worker is incomparably less free than the common worker in Japan. The Japanese man of the people—the skilled laborer able to underbid without effort any western artisan in the same line of industry—remains happily independent of both shoemakers and tailors. His feet are good to look at, his body is healthy, and his heart is free. If he desire to travel a thousand miles, he can get ready for his journey in five minutes. His whole outfit need not cost 75 cents; and all his baggage can be put into a handkerchief. On $10 he can travel for a year without work, or he can travel simply on his ability to work, or he can travel as a pilgrim. You may reply that any savage can do the same thing. Yes, but any civilized man cannot; and the Japanese has been a highly civilized man for at least a thousand years. Hence his present capacity to threaten western manufacturers. We have been too much accustomed to associate this kind of independent mobility with the life of our own beggars and tramps to have any just conception of its intrinsic meaning. Your Japanese tramp takes his hot bath daily, if he has a fraction of a cent to pay for it, or his cold bath if he has not. In his little bundle there are combs, toothpicks, razors, toothbrushes.

Ability to live without furniture, without impedimenta, with the least possible amount of neat clothing, shows more than the advantage held by this Japanese race in the struggle of life; it shows also the real character of some weaknesses in our own civilization. It forces reflections upon the useless multiplicity of our daily wants. We must have meat and bread and butter; glass windows and fire; hats, white shirts, and woolen underwear; boots and shoes; trunks, bags, and boxes; bedsteads, mattresses, sheets, and blankets; all of which a Japanese can do without, and is really better off without. Think for a moment how important an article of Occidental attire is the single costly item of white shirts! Yet even the linen shirt, the so-called "badge of a gentleman," is in itself a useless garment. It gives neither warmth nor comfort.

The absence of any huge signs of the really huge things that Japan has done bears witness to the very peculiar way in which her civilization has been working. It cannot forever so work; but it has so worked thus far with amazing success. To-day there is visible a tendency to hardening—a danger of changes leading to the integration of just such an officialism as that which has proved the curse and the weakness of China. There are two forms of the cultivation of self. One leads to the exceptional development of the qualities which are noble and the other signifies something about which the less said the better. But it is not the former which the new Japan is now beginning to study. I confess to being one of those who believe that the human heart, even in the history of a race, may be worth infinitely more than the human intellect, and that it will sooner or later prove itself infinitely better able to answer all the cruel enigmas of the weird sphinx of life. I still believe that the old Japanese were nearer to the solution of those enigmas than are we, just because they recognized moral beauty as greater than intellectual beauty.—Lafcadio Hearn in Atlantic Monthly.

The Influence of Alcohol on the Longevity of Man.

Dr. Crothers, of Hartford, who has had long experience in the management of institutions for the inebriate and insane, says that "inebriety is the active cause of from 15 to 50 per cent of all insanity; from 30 to 80 per cent of all idiocy; from 60 to 90 per cent of all pauperism, and from 50 to 85 per cent of all crime," then asks the question, "Who can estimate the relief of the taxpayers by the removal of the perils to both property and life from drunkenness?"

Dr. Day, of Boston, in his late annual report of the Washington Home for the Treatment of Inebriates, says: "On the individual the effect of vicious alcoholic indulgence is disease of the body. Sooner or later it must succumb. Disease of the mind is not far off. It may be delirium or insanity."

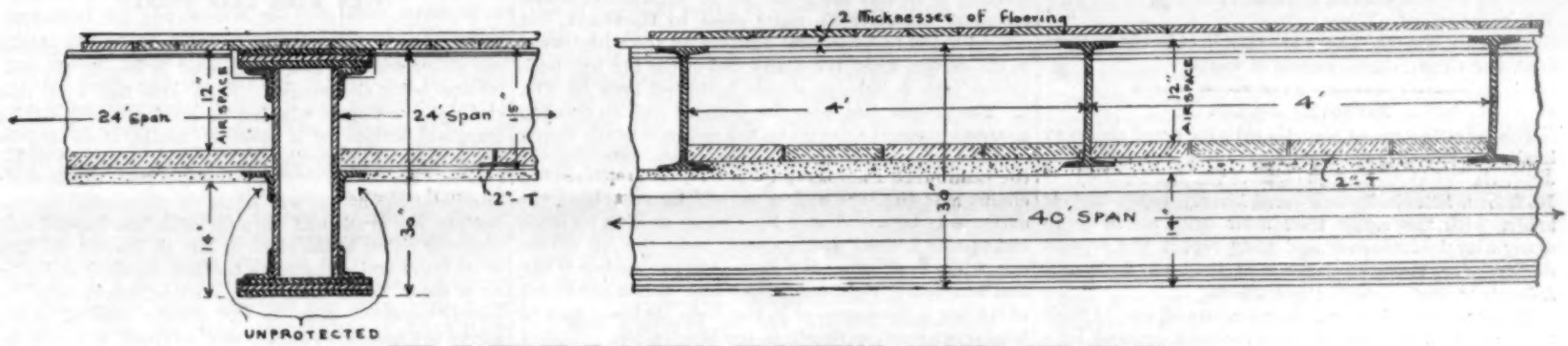
Dr. Formad found in the dead house autopsies of the Philadelphia Hospital that in 250 chronic alcoholists nearly 90 per cent had fatty degeneration of the liver, 60 per cent had congestion or a dropsical state of the brain; the same number an inflamed or degenerated stomach, while not quite one per cent had normal kidneys.

To be convinced of the cause of so much pauperism in the country, we have only to examine the statistics of the liquor traffic in the United States. "According to the report of Internal Revenue Commissioner Mills, for the year 1892, the patrons of the saloons paid $609,000,000 for whisky and $617,258,460 for beer, a total of $1,226,259,460, the interest of which for one minute at 6 per cent per annum is $8,515.69." This would more than pay off the national debt, and would feed and clothe all the poor of the country.

When we look abroad over the world and take a bird's eye view of the evil effects of intemperance in its various aspects, its production of disease and death, the destruction of happiness and home, pauperism and crimes innumerable, with general demoralization, we are astonished that any thinking man, much less a physician, should come to the conclusion that drinking men and drunkards enjoy greater longevity than total abstainers.—The Medical Progress, April, 1895.

Joseph Bell.

Shortly after the recent races of passenger trains between London and Aberdeen, an aged man died in London to whom these races must have been of unusual interest. This was Joseph Bell, who died at the age of 83. He was, in his youth, the engineer of George Stephenson's famous Rocket. He was probably, before he died, the oldest railroad man living, and to him was indeed given an unprecedented experience. He had seen and had personal experience of every change and development of the carrying industry which has revolutionized the world. He heard Stephenson's prophecy that a locomotive would attain a speed of ten or twelve miles an hour. He ran the Rocket at 15 miles an hour on the average; reached 29 miles an hour, and made on a later occasion the wonderful "world's record" of 35 miles an hour. And he lived to see trains run for hundreds of miles at more than a mile a minute, and for shorter distances at speeds exceeding 100 miles an hour. As evidence of the fact that locomotive running is a healthy occupation, it may be stated that Mr. Bell continued in active service until about 18 months of his death, running on the London District Railway, and, finally, that he died, not of old age, but through an accident, having fallen into an open cellarway.



THE MANHATTAN SAVINGS INSTITUTION—GIRDERS AND BEAMS.

Cycle Notes.

It is not necessary to go away from home to find the "new woman;" that is, the woman who has been almost created anew by the bicycle and a close observation of the laws of health. There are several of them here in Lincoln. One hears very frequently now of a charming woman who has lost forty pounds of nature's generosity, and has had the looks of her girlhood restored to such an extent that acquaintances pass her every day on the street without recognizing her. The transformation was made by dieting, by taking baths and by riding the wheel. When the "new woman" movement assumes this form, the masculine population will take off his hat in cordial and undisguised admiration.—Nebraska State Journal.

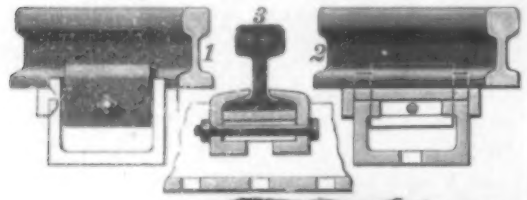
The average output of bicycles for the year 1895 is estimated at 750,000. Allowing an average length of 6 feet per cycle the above output, if the wheels were arranged in a line end to end, would extend 850 miles, or almost from Chicago to New York.

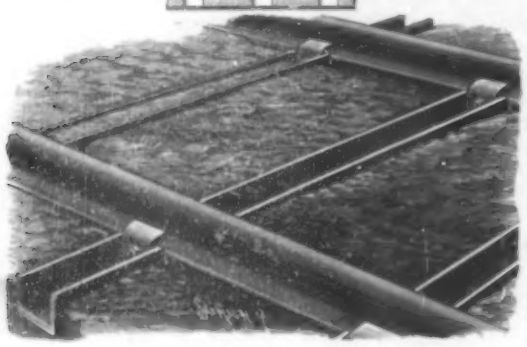
JOHN D. ROCKEFELLER has given the University of Chicago $1,000,000, unconditionally for endowment, to be paid in the year 1896, and $2,000,000 additional, on condition that a like amount be given by other friends of the university before January 1, 1900. If the conditions are met, the total gifts of Mr. Rockefeller to the University of Chicago will amount to $7,425,000.

DIVERS now communicate with persons above the water by means of the telephone. The mouthpiece is placed near the lips, so that a slight turning of the head brings the mouth close to it.

A METALLIC RAILWAY TIE.

This tie is of trough-like form, and is designed to be made of steel or wrought iron, thus being strong while comparatively light in weight, the tie to be filled with broken stone or other ballast to firmly anchor it in place. It has been patented by Royal S. Oliver, of Fillmore, Ind. Fig. 1 is an end view of the tie, Figs. 2 and 3 being transverse sections through the tie and its rail-supporting devices. Near each end of the tie are notches where the metal is turned inwardly to form supports for a chair or rail seat, at whose opposite ends are depending lugs embracing the outer sides of the flanges of the tie. To secure the rail to its seat, clamping plates are employed whose inturned lower edges engage the under sides of the inturned edge portions of the sides of the tie, the clamping plates being held in place by a bolt extending across the space below the seat or chair and between the





OLIVER'S RAIL TIE.

shoulders of the tie. There are openings in the bottom of the tie to permit the escape of water.

IMPROVED DRILLS.

The manufacture of bicycles calls for great accuracy in the machines and tools employed. The W. F. & John Barnes Company, makers of the Barnes drills at Rockford, Illinois, have catered largely to the bicycle trade, with the result that their drills are in use in many bicycle factories, and they report the present demand for them so great that they are finding it difficult to keep up with their orders.

The accompanying cut shows a line of ten of their twenty inch drills which were recently ordered by a large Western factory. These drills are equipped with self-feed and automatic stop, with square tables with T slots and with groove for oil drip, and with a quarter turn device in the countershaft so that the drills can be set closely together and at right angles to the line shaft, so as to economize floor space. A line of these drills thus equipped will give more satisfactory results than could be obtained from a gang or multiple spindle drill, and can be furnished at a considerably lower price. The Barnes Company have supplied a great many of their drills for English factories, and a very large number of their small screw-cutting lathes for the English bicycle repair trade, their English agents having made a fine display of the Barnes tools at the annual English cycle show.

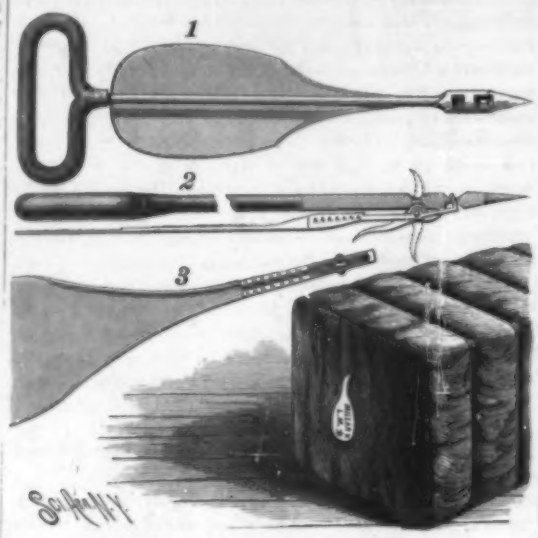
Bursting of a Great Flywheel.

A gigantic flywheel burst in the power house of the Albany Railway Company on the afternoon of Nov. 12, on lower South Pearl Street. Four persons were injured, one of them mortally, in a saloon opposite the power house. One piece of the wheel tore out the whole front of the saloon and another the whole upper portion of the house. Nobody in the power house was hurt.

The house of Mrs. Elizabeth Metz, two blocks away, was wrecked by a flying piece of the wheel, eight feet long and four feet wide, and weighing four thousand pounds, which descended in a slanting course, striking the top of the house and tearing out a whole side. A section of the north side of the power house, twenty-five feet wide and extending from the ground to the roof, was torn out, and one of the engines and a generator were demolished. The damages amount to $30,000.

A COTTON BALE TAG AND TAG DRIVER.

For the tagging of cotton in such manner that it can be readily distinguished and picked out from any cargo when there are numerous shippers, and



MILLAR'S TAG AND TAG DRIVER.

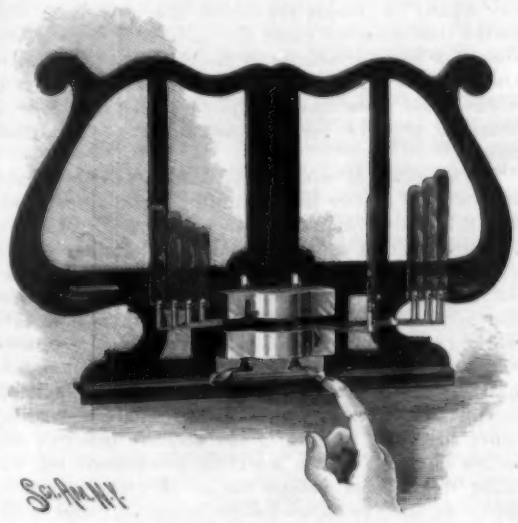
especially where the marks have been liable to defacement or destruction in compressing, or where they may have been liable to removal or obliteration by water or fire, the improvement shown in the accompanying illustration has been designed and patented by William L. Millar, of Charleston, S. C. Fig. 1 shows the driver and tag attached, Fig. 2 being a side view partly in section, and Fig. 3 a partial plan view of the tag, which is of metal and has a shank turned over on its edges, the flanges having roughened edges and side surfaces. At the rear end of the shank is an upwardly turned lip, and in its sides are ears adapted to receive the pivot pin of an anchor, whose members normally lie quite close to the shank, but are extended to horizontal position by the withdrawal of the driver, when the shank end of the tag has been forced into a bale, as shown in dotted lines in Fig. 2. The driver has near its pointed end an opening adapted to receive the lip on the rear end of the shank of the tag, a recess in the driver also receiving the ears on the shank of the tag, and when the driver thus connected with the tag is forced into the bale, the driver may be withdrawn by simply moving its inner end upward, which disengages it from the lip of the tag, while in drawing the driver out the anchor is carried to a nearly right angle position. When the shank of the tag is thus secured in the bale, its body may be bent downward, as shown in the illustration.

A Bell Telephone Motion Denied.

The Supreme Court of the United States denied, Nov. 11, the motion of the Bell Telephone Company to dismiss the appeal of the United States in the case involving the Berliner speaking microphone. The court holds that it has jurisdiction to try the case.

AN EFFICIENT MUSIC LEAF TURNER.

This is a device for attachment to a piano or organ or other instrument, or to a music stand, and may be readily manipulated by the performer to turn the sheets singly from left to right or right to left. It has been patented by George Vix, of No. 24 State Street, New York (rooms 316, 317). Attached to a lyre, a bottom board of which may be conveniently placed upon or clipped to an instrument or music stand, is a casing within which a vertical stationary shaft is centrally journaled, and on the shaft is loosely mounted a hollow cylinder having a spiral opening around its front face, the cylinder forming virtually a spring-controlled carriage for music-turning arms. The cylinder is normally pressed upward by a spring, and the casing has a horizontal opening in its front and sides. Upon the shaft are two collars between which the hub ends of any desired number of music leaf turning arms

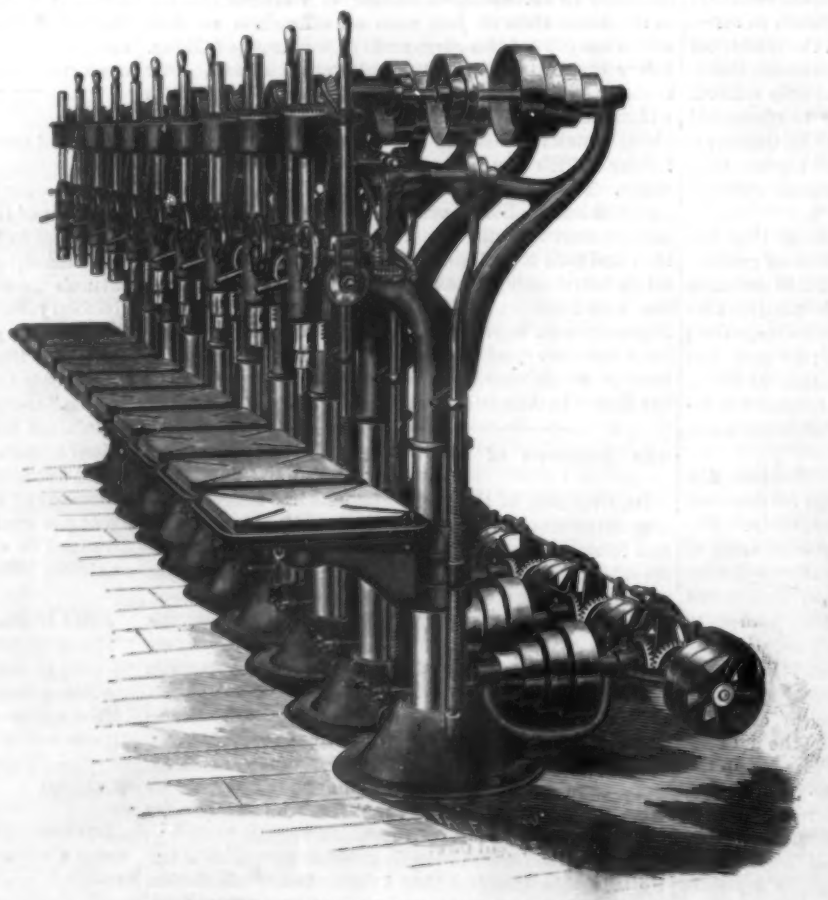


VIX'S MUSIC LEAF TURNER.

are mounted to loosely turn, the arms being placed one above another and graduated in length, the lowest arm being the longest. Each arm has at its free end a clip or fingers adapted to receive and hold the marginal portion of a sheet of music, these fingers being preferably of celluloid, as being light and transparent. By means of a key or finger piece at the right hand and one at the left hand of the casing, at the bottom, the music leaf turning arms are carried successively either to the right or left as desired, the key at its inner end actuating a toothed segment and gear on a shaft controlling the shifting mechanism. A loosely mounted gear on the central vertical shaft, above the hollow cylinder, and adapted to move up and down with it, is connected with the shifting mechanism, and as each key is pressed a shifting arm is made to travel in a circle in front of the cylinder to one side or the other, carrying with it a leaf-turning arm, and correspondingly depressing the cylinder, or allowing it to rise, a distance equal to the thickness of the arm, a lock-latch on each side always engaging the arm next to the one that is turned, so that only one arm will be turned at a time. The mechanism works smoothly and with a minimum of friction, and the parts are constantly in position to cause the leaf or music turning arms to respond instantly and positively to the movement of either of the key levers.

New Felted Fabric.

Some experts highly commend the new French felted fabric for use as a substitute for the felts ordinarily employed on paper machines. The new manufacture is described as consisting of a metallic thread warp, either of bronze, brass, copper, iron, steel, aluminum, etc., and the metal may be pure or alloyed nickel or galvanized, round or flat—may also be either uncovered or covered with any textile or other material, according to the purpose for which it is required. The weaving is done with metallic threads or yarns, interwoven with those of wool, cotton, hair, ramie, or other felting material, the weaving being either flat, with a seam, or on a circular or other loom—in the first case the seam being made either by means of a splice or by soldering, and in the second the movement of the shuttles being made to ascend and descend, or see-saw, in order to weave above or under the felting material. After the weaving the felting is produced by means of cylindrical beaters, and the finishing completed by the usual machine.



A LINE OF DRILLS FOR A BICYCLE FACTORY.

Men of Stone.

Among the natural wonders of the Southwestern States of America, says the Pendleton East Oregonian, are the Superstitious Mountains, which loom up from the arid desert to the east of the Salt River Valley. These mountains are so curious that, as long as Arizona has been settled, the Indians would have nothing to do with them. In consequence they are full of deer, ibex, bear, and other big game. The Superstitious Mountains rise out of the level surface of the desert like the pyramids of Egypt.

On the crest of this unique range, and in full view of the rarefied atmosphere for an immense distance from the plain, are hundreds of queer figures, representing men in all attitudes. When you look first you are sure they are men, and when you turn your gaze again to them you are as absolutely certain of it as you can be of anything.

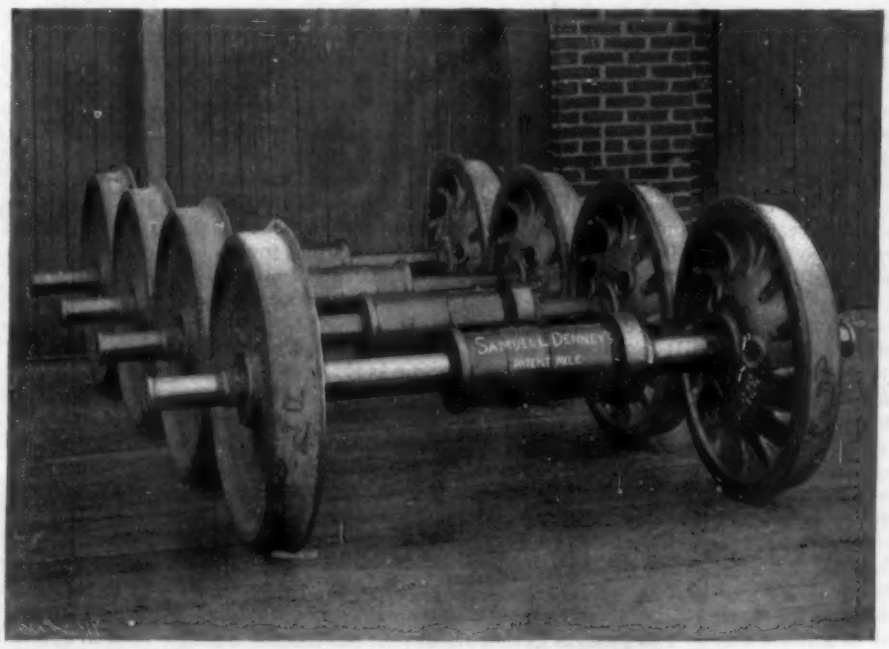
They represent ball throwers, outlooks, mere viewers of the country roundabout, men recumbent and contemplate, others starting on a foot race, and in every conceivable posture and position. They are not real flesh and blood men, however—nothing but stone sienite—yet, nothing can convince the Indians and some white men that they are not genuine. They say they are real mortals turned to stone, petrified by the peculiar condition of the air on the mountains.

This belief has grown out of an Apache legend handed down for hundreds of years. They have it that an ancient chief, who had learned of the curious character of the Superstitious Mountains, forbade any of his people to go there. A large band, however, one day discovered a way to get in by a precipitous route, and finally reached the top. It resulted as the chief had said—they never got down alive.

DENNEY'S DIVIDED CAR AXLE.

It is well understood that the slipping of the wheels of railway cars in rounding curves in the track is the cause of most injurious wear upon both rails and wheels, besides adding largely to the work of the locomotive. The difference in the length of the rails on a long curve is considerable, and this difference must be equalized by the wheels on the inner circle of the curve revolving without going forward. The outer rail is also made higher to counteract the momentum of the train and prevent the car leaving the track, throwing the greater portion of the weight of the cars upon the wheels which slip. The torsional strain thus thrown upon the axle centers at the inner face of the hub of the wheel, and is so great that the axles at that point are made larger than the journals, while the twisting strain required to slip the wheels on the curves has been considered more destructive to the wheels than all other trials to which they are subjected. It is also to be added that, besides the danger of derailment when cars are run at a high speed around curves, the rapid cutting away of the rails and the increased demand upon the motive power, the cars surge and sway in a manner which adds greatly to the discomfort of traveling on all fast trains.

An improvement designed to obviate these disadvantages has been patented by Mr. Samuel L. Denney, of No. 2425 Atlantic Avenue, Atlantic City, N. J., and is represented in the accompanying illustration. It consists of an axle divided in the center, the sections being connected by mechanical devices which allow the wheels to adjust themselves to the radius of the track curve, while no movement takes place in the connection except as caused by passing around curves. Our picture is made from a photograph of a set of the wheels just previous to shipping by the Lobdell Car Wheel Company. The two parts into which the axle is divided abut together in the center of a main coupling cylinder, and the inner end of one section is of an elongated cone shape and fitted with a sleeve forming a bearing in which the cone revolves only when acted upon by the curvature of the track. The sleeve fits closely in the outside cylinder, and is allowed to move endwise to take up wear, although prevented from turning with the axle. A screw cap bears against the outer end of the sleeve whereby the cone is made to bear against the end of the straight section of the axle, which is forced firmly into the coupling. The bearing surface of the two ends is so large that no change of the gage ever takes place, while the wear in the sleeve is so slight as to need adjusting only once in twelve months and oiling once in three months.

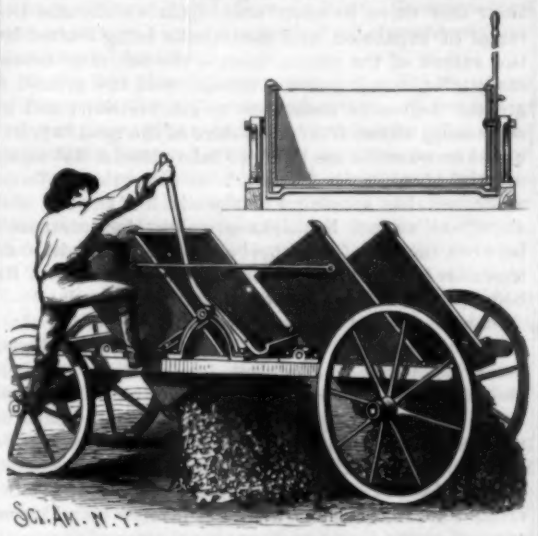


DENNEY'S DIVIDED CAR AXLE.

This construction of axle has been tested in a way to demonstrate its thorough effectiveness and the desirability of equipping therewith cars, tenders and the pony trucks of locomotives where there are curves in the roadbed. The axles and the wheels are thus free from all torsional strain and are acted upon only by the rolling pressure, greatly extending the life and serviceability of the running gear of the rolling stock and making it less expensive to keep the track in good condition.

A TWO-PART DUMPING WAGON.

A wagon whose body is made in two pivoted parts, adapted to be dumped by means of a lever fulcrumed on the wagon frame, is shown in the accompanying illustration, and forms the subject of a patent issued to



THEOBALD'S DUMPING WAGON.

John J. Theobald, Galveston, Texas. Each of the parts is hung at or near its middle on trunnions journaled in bearings in the frame, and the two parts are pivotally connected by a link, so that when one part is swung the other part swings with it. On one side of one of the body parts, as shown in the small sectional view, is a pin engaging a slot in an arm of a lever fulcrumed in a bracket at one side of the frame, and by the swinging of this lever the slotted arm operating on the pin causes the two parts of the wagon body to swing into inclined position, as shown in the illustration. The two parts normally extend horizontally and are jointed together at their adjacent ends to form a single wagon body. To lock the two parts thus in horizontal position there are lugs on the lever on opposite sides of its fulcrum adapted to engage cams on each of the wagon body parts, locking them securely to each other at their joint.

Mr. Atkinson on the Atlanta Exposition.

Edward Atkinson, who has been visiting the Atlanta Exposition and traveling in the South, was interviewed on his return to Boston by a representative of the press regarding the impression made upon him by the Exposition and matters pertaining to the material prosperity which came under his observation during his trip. The replies elicited from Mr. Atkinson were extremely interesting, as would naturally be expected from so keen and thoughtful an observer. The Boston Journal of Commerce says the Atlanta Exposition impressed him very favorably, and taking everything into consideration, he considered it, next to Chicago, the most remarkable exhibition in its method, in its picturesque aspect and in its extent, especially considering the fact that it has been mainly brought into existence by a relatively small city. "One who goes there," says Mr. Atkinson, "for the mere purpose of seeing a great show or passing through a great bazar would, of course, not find the conditions which were met with at Chicago. Yet there is a wide extent of park, a natural lake with its electric launches, numerous buildings, which, although constructed of wood, and not pretending even to be the semblance of stone, present a very interesting picture; and in the evening, when even more fully illuminated than the Chicago buildings were, these buildings present a most picturesque and enchanting appearance. The collections of minerals, timber and of the products of agriculture in the Mining, Forestry, and Agricultural buildings are more complete, in respect to the section which they represent, and are more systematically arranged for thorough investigation than even those at Chicago. The Government building, with its contents, has never been excelled, if it has been equaled. The best and most thorough experts in the country—Dr. Dabney in the department of agriculture, Dr. Day in department of mineralogy, Professor Fernow in forestry—and their assistants, have made these exhibits great object lessons from which I think there may be a greater development in the immediate future than ever occurred from any exhibit brought together before, possibly excepting the Atlanta Exposition of 1881. That exhibition marked more beginnings in the development of the South than any one ever can again, because the wide field for improvement was then almost wholly unoccupied."

Speaking of the various buildings devoted to manufactures, Mr. Atkinson says: "There is evidence of an immense start in the varied branches of industry which tend to make a society whose occupations are diversified, and in which men of aptitude find ever-increasing opportunity. Southern manufactures of cotton are to be found on an extensive scale, and the opportunity is given to every one who is an expert in that art to take note of the relative advantages of the South in some departments, and its disadvantages in others, so as to form a clearer conception of what may be the future status of the cotton manufacture than has ever been possible in any former exhibition. I was disappointed in not finding object lessons in the improvement of the cotton itself and of the cotton bale on any extensive scale, but the air is full of the improvement in cotton at every point, the changes yet brought about being too recent to have enabled their promoters to make any great show. In my own judgment, as I stated in many interviews in Atlanta, there is a much greater field for improvement and there will be a much larger profit in the improvement of the cotton fiber in the next ten years, in handling, ginning and baling, and in sending it to the market in better condition, than there can possibly be in converting badly handled cotton, badly ginned cotton, and badly baled cotton into cotton fabrics in competition with sections where the art is old, where the people are trained by long aptitude to the work and where all the surrounding or lesser arts, which are necessary to complete success, are already well established. There will, of course, be great success in the manufacture of special fabrics at the South, mostly under the control of individual owners, who are, some of them, men of great capacity, and who fully comprehend all the minutiae of the work. I have not that confidence in the immediate success of the widely scattered factories, promoted by corporations having many other objects in view than the mere profit upon the goods, which many of my Southern friends possess."

Canadian Enterprises in Argentina.

Canadian capitalists are interesting themselves in the project of an electric street railway in Buenos Ayres, Argentine Republic. The city has 750,000 inhabitants, and there are only two streets in which the electric company has not the right to lay down tracks.

It may not be known generally that the Canadian export trade with the Argentine Republic, which ten years ago was only $200,000, is now more than $4,000,000 a year. Almost all the agricultural implements and machinery used in the republic, and many other manufactured goods that should be made and exported from the United States more cheaply, are obtained from Ontario, and this trade is increasing annually, although those persons who are interested in it are careful to say as little as possible about it for fear of arousing competition.

THE EARLIEST PNEUMATIC TIRES.

BY HAWTHORNE HILL.

One can readily believe that the attention of visitors to the fashionable parks in London, at a certain period just a half century ago, was "much attracted" by the appearance among the gay equipages of a certain brougham, after reading the contemporary descriptions of the latter. The vehicle had been constructed without springs, but its chief novelty lay in certain "improvements" patented by a civil engineer of Middlesex County, named Robert William Thomson, in the shape of what he called "noiseless tires." They were, in fact, the pioneer pneumatic tires, and the inventor had boldly started out to exhibit them on the wheels of a brougham weighing nearly 1,200 pounds. This year of 1895, marking, as it does, the semicentennial of so many important applications of India rubber, seems a proper occasion for recalling Thomson's "patent aerial wheels," though it is not proposed to connect their invention, by any link, with the pneumatic tires which have since become more successful.

"The nature of my invention," said Thomson in his specification, No. 10,990 of 1845, "consists in the application of elastic bearings round the tires of wheels of carriages, rendering their motion easier, and diminishing the noise they make while in motion. I prefer employing for the purpose a hollow belt composed of some airtight or watertight material, such as caoutchouc or gutta percha, and inflating it with air, whereby the wheels will in every part of their revolution present a cushion of air to the ground, or rail, or track on which they run."

This elastic belt, as Thomson called his inner tube, was composed of several thicknesses of canvas, each "saturated and covered on both sides with India rubber or gutta percha in a state of solution," laid one upon another, and each "cemented to the one immediately below it by a solution of India rubber or gutta percha or other suitable cement."

How the edges were joined to complete the belt as a tube is not mentioned, though other particulars follow: "The belt thus formed is then sulphurized by immersion in melted sulphur or exposure to the fumes of burning sulphur, which renders it more pliable and prevents its getting stiff on exposure to the cold; or the belt may be made of a single thickness of India rubber or gutta percha in a sheet state and sulphurized as aforesaid and then enclosed in a canvas cover."

But it was the outer casing or cover that first caught the public eye, and to understand its construction one must refer to the drawings. A represents the end of a spoke; B is a section of the wooden felloe, much broader than usual and tired with steel; C is the inner tube; and D is the leather shoe. The latter was built upon the wheel by attaching two long strips of leather to the whole circumference with bolts inserted through the felloe and steel tire at every few inches. The outer edges of these strips were brought together over the inner tube and riveted together, after which the tire was complete.

Or a third strip of leather might be used, as shown in the drawing to the right, being riveted to one of the base pieces and laced to the other. A pipe through which to inflate the inner tube was passed at one place through the tire of the wheel, and fitted with an airtight screw cap. In the lower drawing is shown the "condenser" used for inflating the tube. It was the size of Thomson's tires, next to the noiselessness of the wheels, that most attracted attention. They were about five inches in diameter, intended to be so inflated as to keep the tire of the wheel 2½ inches from the ground, which was thought to be "sufficient to admit of the wheel passing over any stones or other matters projecting beyond the general level of any ordinary turnpike road without the solid tire coming in contact with them." Wagons for the carriage of goods were expected to need tubes of a larger diameter and stronger materials.

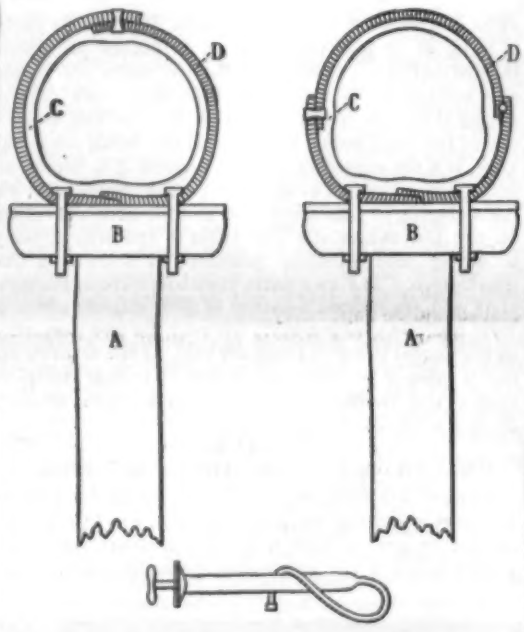
In commenting upon the new style of wheels the Mechanics' Magazine (London), after the trial brougham had been drawn upward of 1,200 miles, without "the slightest symptoms of deterioration or decay" in the tires, had this to say: "It has so long been regarded as a settled thing that friction is least with hard substances, and greatest with soft, that by a natural, though not perhaps strictly logical, course of induction, we inferred that, though in this case the noise might be less, the friction, and consequently the tractive power required, would be greater. We must candidly own that we little expected to find the very reverse of this to be the fact. Yet so it is." Then are given the results of experiments made with Thomson's wheels in the Regent's Park by a noted firm of coach builders, and verified by the editor, showing the comparative lightness of draught of the "aerial" wheels, both on a smooth and firm road and on a section covered with newly broken stone. The table follows, showing draught in pounds:

	Common Wheels.	Patent Wheels.	Saving by Pat. Wheels.
Over smooth, hard road.....	45	28	60 per cent.
Over new broken flints.....	120	38½	310 per cent.

Evidently our pioneer inventor had given much thought to his work, for in his specification he treated at length of the variations possible in the construction of the pneumatic tire, in order to make the patent as "broad" as possible. Some of it is good reading, too, as showing the ideas he entertained with regard to the properties of air in wheel tires. Here is a quotation:

"Any undue displacement of the air at the bearing points of the wheel may be prevented by tying the tubes across at distances of two or three feet apart, so that each tube shall be divided into a number of separate air tight compartments. Or . . . the belt may be formed of separate and distinct sections, each section having its own air pipe [think of having more than one valve to each wheel!], in which case the range of expansion and contraction being limited by the extent of the compartments, the belt must necessarily offer at each point of contact with the ground a greater degree of resistance to compression; and in some cases where, from the nature of the roadway, frequent concussions are likely to take place, a flat strap or band of sulphurized caoutchouc or gutta pecha or other suitable substance of the width of the tire and about half an inch in thickness might be interposed between the tire of the wheel and the elastic belt, so as to render it less liable to rupture in the event of its being jammed between the roadway and the tire."

One variation of Thomson's original suggestion of an inner tube was that several tubes might be employed for a single tire—up to nine, for instance. In such cases the ordinary air pipe would have to be dispensed with, the inflation being accomplished by means of air screws in one end of each tube before they were laced into the leathern envelope. It was suggested that the leather might be protected from wear by covering its outer surface with flat-headed metal rivets secured on the inside with small washers.



The latter end of the "aerial" wheel is not certainly known, but tradition has it that its inventor was much laughed at. Six years after the date of his pneumatic tire patent, Thomson's name appeared in the catalogue of the Great Exhibition of London, in connection with an invalid chair, of which "the wheel (in addition to an iron tire) is shod with a solid band of vulcanized India rubber, said to be as durable as iron." As late as 1868 all the scientific journals in Europe were describing Thomson's solid India rubber tires (five inches thick) for traction engines for common roads.

It is probable that John Boyd Dunlop, now in the enjoyment of fame and fortune as the result of experimenting with air tires on his young son's tricycle, had never heard, when he applied for his first patent, of the pioneer inventor in this field. It is not impossible, however, that the impending litigation over the Dunlop patents may lead to a judicial decision somewhere that the essential features of the latter were embodied in Thomson's patent of 1845.—India Rubber World.

A Storage Battery Lighting Plant for a Residence.

The Electric Review states that the Electric Storage Battery Company, of Philadelphia, has recently closed a contract for a complete electric lighting plant for Mr. Frank Thomson, vice-president of the Pennsylvania Railroad Company. The plant consists of an Otto gasoline engine, capable of giving 26 actual horse power. The engine is belted to a four-pole shunt-wound dynamo having a capacity of 20 kilowatts.

The storage battery consists of 60 chloride accumulator elements in lead-lined tanks. These cells have a capacity of 1,000 ampere hours at a 10 hour discharge rate, but provision is made in the lead-lined tanks to double the number of plates, thereby increasing the capacity to 2,000 ampere hours. The power house and storage battery room is situated about 300 yards away from the residence at Merion, Pa., the current being conveyed by a 300,000 circular mil cable run partly on poles and partly underground. The power house has been specially designed and built for a private house lighting plant, and the whole installation will be as complete as it is possible to make it.

Liquid Air in Commerce.

An interesting illustration of the rapidity with which purely scientific discoveries frequently become the starting point of new industries is furnished by the case of liquid air. It is no long time since liquid air was produced for the first time in quantities great enough to admit of its application for purposes of research; yet steps are already being taken to treat liquid air as an article of commerce and to turn it out upon a large scale. As in most cases of the kind, laboratory methods require modification to suit the needs of wholesale production. Patents are being taken out for machinery which, though constructed upon the principles of that used for purposes of research, will attain the desired end with greater directness and with the omission of several intermediate steps. The necessary reduction of temperature to the critical point of air has hitherto been effected by the successful employment of liquefied gases boiling at lower and lower points on the scale. But the final decrement of heat has been won by the cooling effect due to the rapid evaporation of the product itself. The new apparatus dispenses with the use of these intermediate cooling agents and relies entirely upon initial compression by powerful engines and subsequent partial expansion of the compressed air under carefully regulated conditions.

Most people probably have seen at one time or another the familiar lecture room experiment of forcing a piston suddenly down a cylinder, and showing the ignition of a scrap of touch paper by the heat thus produced. If, while the compression is maintained, the cylinder and its contained air be cooled to the original temperature, then, on suddenly withdrawing the piston and allowing the air to regain its original volume, there will be a fall of temperature corresponding to the rise on compression. If now the cooled air could be used to reduce the temperature of a second quantity of air before expansion, it is evident that, starting from a lower point than the first batch, the second would on expansion reach a lower point. This is the principle of the new liquid air apparatus. A powerful engine compresses air, which is cooled as far as possible by ordinary refrigerating methods, and passed into a spirally coiled pipe, over 100 yards long. This pipe is inclosed in a second spiral. By means of a throttle valve at the end of the inner spiral a certain proportion of the compressed air is allowed to expand in the space between it and the outer pipe. Thus the stream of compressed air from the pump is cooled by that portion which has been allowed to expand, and arrives at the throttle valve in a colder state than the portion that preceded it. Consequently it reaches a still lower temperature on expansion, cooling yet more powerfully the advancing stream in the inner tube. By carrying this cumulative cooling effect sufficiently far the circulating air is at last brought down to its critical point and liquefies, after which a continuous stream of liquid air is merely a question of engine power. It is impossible without the aid of diagrams to explain clearly how the continuity of the process is maintained, but the cycle of operations can be readily apprehended. There is compression, expansion in a closed chamber, and utilization of the cold thus produced to repeat the cycle from a lower initial temperature.

The inventor, Herr Linde, who is a man of great experience in refrigerating machinery and methods, believes that a large demand will shortly arise for this most powerful of all refrigerators. In the meantime his apparatus produces with the greatest ease a substance for which there is already a large industrial demand—oxygen gas. During the process just described the air becomes steadily richer in oxygen until that gas forms some 70 per cent of the product. This relatively pure oxygen is sufficiently good for certain purposes, and it may be further purified from nitrogen if desired. The price of oxygen gas thus obtained compares favorably in respect of cost with that produced by the methods now in use. It would have been gratifying to have been able to announce that this commercial application of recent scientific ideas, so closely associated with the Royal Institution, had been made in England. But, unfortunately, in this, as in so many other cases, it has been "made in Germany," where there is at present far more alertness and a far higher standard of technical knowledge than among ourselves. It is obvious from what has been said that this process is an affair of engineering far more than of chemistry. This remark applies to many of the most important and lucrative manufacturing processes of the day, and, unhappily, engineering chemistry, or chemical engineering, is just one of the things in which the Germans are conspicuously superior.—London Times.

Orchestral Women.

It is quite true that an occasional and very exceptional woman has been known to make a fair soloist on brass and wood wind instruments, and by dint of searching as many women might be discovered in a generation as might be trained to handle the brass and wood wind sections in an orchestra, but the same argument will apply to them as to their sisters of the fiddle. It is one thing to be able to perform a solo well and quite another to sustain a position in an orchestra. To appear before the public for twenty to thirty minutes incidentally and play a sonata and concerto is no test whatever of the capacity to work steadily in an orchestra from two to three hours at a stretch, attention concentrated on a conductor's desk, and this point of a performance having been reached through months of arduous rehearsal. The most capable and intelligent of women can never become factors in an orchestra of any serious aims for this reason.

It boots little to argue the question of feminine capacity to handle one instrument better or worse than the other. Taking it for granted that woman could accomplish as good results with every other instrument of the orchestra as she can with the violin, her physical incapacity to endure the strain of four or five hours a day rehearsal, followed by the prolonged tax of public performances, will bar her against possible competition with male performers. She may learn to play the trombone if she please just as well as the fiddle, but she will never arrive at playing it in an orchestra throughout works of any special moment, which have demanded consistent and protracted labor for their study. The female violinist who laudably divides honors with her male brethren is well equipped technically for a good position in an orchestra. There are dozens of young women who play well enough for an orchestral place. But even were a mixed orchestra of men and women together a condition probable enough to consider, about how many works of novelty and magnitude in a year would the ordinary woman find herself physically equipped to carry through rehearsal? Not more than a third, probably, of what men are able to do. Women for solo work can increase their repertoire by degrees of their own arbitration, rehearsing how and when they please, but the grinding tax of rehearsals with an orchestra which undertakes the production of several weighty novelties each season, together with keeping in the best order a long list of standard works, would send her physical forces completely to the wall.—Musical Courier (South Africa).

The Defender's Bronze.

We have received a sample of the bronze plates of which the under-water portion of the hull was formed, and we are confirmed in our opinion that her victory was due to the resourcefulness and originality of her builder, who, casting aside the traditions of boat building, boldly adopted the best material he could find. The plate before us is of Parsons manganese bronze, and has a guaranteed tensile strength of 34 to 36 tons per square inch, with an elongation of 27½ per cent in 8 inches. It was rolled at Olney, Philadelphia, by the Parsons Manganese Bronze and Copper Company, and is remarkable for the splendidly smooth surface which it carries, the result of special treatment in the rolling mill. The metal has a mottled surface, somewhat like that of the calf leather in which books were once bound, and is so bright that it is possible to see one's face in it, although, of course, not very distinctly. The same material was brought to the notice of the designer of the Valkyrie before she was built, but was not adopted by him. Possibly the question of expense had something to do with his decision, but the America Cup is not to be won by the exercise of economy.—Engineering.

The Electric Locomotive of the Baltimore and Ohio Railroad.

A test made on October 6 has added a new record to a list of remarkable performances of this locomotive. The character of the performance is heightened by the fact that the train which it moved measured over 1,800 feet in length and weighed about 1,900 tons and was started from rest in the tunnel. It consisted of a north-bound freight train of 28 loaded cars and two locomotives coupled to a local freight of 15 loaded cars and one locomotive. In starting it is said that not a sputter, spark or slip of the wheel occurred, and the train moved with the same precision as if the circumstances had been of the ordinary character. The drawbar pull of 60,000 pounds is given as the record in this case. The train was quickly brought to a speed of 12 miles an hour and pulled through the tunnel without difficulty with the locomotive continuously exerting a drawbar pull of 40,000 pounds.

AT the recent election in the State of New York the people voted in favor of the proposition to expend nine millions of dollars toward the improvement of the Erie and other canals. This canal, it will be remembered, connects the waters of the great lakes with the Hudson River at Albany, and so on to the Atlantic Ocean.

A Method of Stereoscopic Projection.

BY H. W. SCRIPTURE, YALE UNIVERSITY.

Exhibitors of lantern views have often made attempts at relief effects on the screen. Such attempts necessarily fall short of true relief on account of the neglect of the fundamental fact of binocular vision, namely, that two slightly different views must reach the two eyes separately. No manipulation of the lanterns or the screen can get around this psychological law.

Having promised to deliver a public lecture on binocular vision, it occurred to me that unless I could show actual pictures in relief to the audience, the lecture would be folly of the worst kind. To escape from the quandary I sought a method of stereoscopic projection and found it.

In the first place it is necessary to be able to present pictures to the two eyes separately. Spectacles of colored glass, with a particular red for the left eye and a particular green for the right eye, can be arranged so that green light of a definite color cannot get into the left eye and red light of a definite color cannot get into the right eye, whereas each can get to the eye having a glass of the same color.

In the next place it is necessary to present the pictures in the aforesaid green and red lights. This is done by using two lanterns, one throwing green light and the other red light.

In preparing for an exhibition various details must be attended to. The colored glasses are made from the standard red and green glass used by railways. When a piece of red is placed over a piece of green, no light ought to get through. The faint brown light that actually does get through has no appreciable effect. This is the way in which I test the glasses. I first select several squares of red and several squares of green that together permit only a faint light to go through them. This eliminates a very disturbing kind of glass made for railways by some manufacturers. To the eye it differs very little from a true red, but it lets nearly all the green rays through. Then from the red squares I reject all that are too deep in color; otherwise the light of the lantern is so much weakened as to be scarce visible to the audience. Finally, for lime-light lanterns, I select a very light (thin) red square and a moderately dark (thick) green one, and for electric lanterns a light red one and a very dark green one. These squares are inserted behind the slide carriers and in front of the condensers. The green square sometimes cracks from the heat; therefore several should be kept ready.

In regard to the spectacles, I adopt the following procedure: For economy's sake I use merely two pieces of glass about one inch square, held before the eyes with the two hands. Eyeglasses with the two glasses can be obtained for about $13 per hundred, spectacles for about $15. By a little maneuvering the plain colored squares can be obtained for about $1 per thousand. The "maneuvering" consists in buying refuse chips where railway signals are being made. An understanding with the glass cutter will cause him to throw into one keg all the green chips and into another all the thin red chips. These are afterward cut into small pieces. The red pieces must be sorted. A sheet of green is supported on two blocks above a white surface; the red pieces are scattered over it, and all which let through the green light (the peculiar red referred to) and all that are very dark are rejected.

From the stereoscopic negative two lantern slides are made, one from each half. The picture intended for the right eye is placed in the green lantern, that for the left eye in the red lantern. Both are thrown together on the screen. When the spectacles are held before the eyes, the image for the right eye is selected by the green glass and that for the left eye by the red glass. The two pictures thus reach the eyes and the brain separately. The result is an actual relief.

The relief appears just as real as a real object; this is necessarily the case. For example, in looking at the room in which you sit each of your two eyes receives a different picture, as can be proved by closing one eye at a time. When two such views are projected on the screen and are then gotten to the eyes separately, the result must be exactly the same as before—the relief must be just the same as if the room were actually seen. With one exception, however, the pictures seen by my method appear in lights and shades, the colors being lost.

This reality of the pictures cannot be understood by persons who have only seen pictures in the stereoscope. There the result is a minute relief model. A like effect happens by my method when the screen is too small for life size. A view of the Brooklyn Bridge, for example, appears like a model. But when the pictures are life size, the observer finds it hard to believe that, for example, he cannot actually advance along the shaded roadway before him or step into the boat waiting on the shore, or pat the dog that greets him, etc. The things he sees are, apparently, real objects.

The method is, as far as I am concerned, original. It is also, as far as I can learn, new, although it seems hard to believe that such a simple principle has not already been discovered a dozen times over.

The possibilities of this method in combination with the strobo stereoscopic pictures, such as are used in Edison's kinetoscope, are limitless. By proper arrangements the two sets of pictures of the kinetoscope might be projected in two colors to the same spot on the screen. They would be separated by the colored spectacles and would be seen as real objects. By projecting life sized pictures on a screen in front of a theater stage a whole play might be given, apparently on a real stage. As long as the spectacles are kept on, the audience could not tell the difference from an actual stage except for the lack of color. Edison, dreaming of such a possibility, believes that in coming years, with the aid of the phonograph, "grand opera can be given at the Metropolitan Opera House at New York without any material change from the original and with artists and musicians long since dead." There is no possibility, however, of the relief effect being accomplished unless the two pictures are gotten to the two eyes separately by some such method as I have described.

There is finally one very important application for my stereoscopic method. With very large classes the details of scientific apparatus are invisible to all except a few. The usual remedy is to throw a photograph on the screen. Being a flat view, the student cannot understand it and cannot become interested in it so well as if he viewed the real thing.

Suppose, for example, the lesson is on the graphic method of recording time. The instructor sets up the chronograph, etc., and takes a stereoscopic view. The stereoscopic slides are made and projected. Each student then sees by my method an apparently real chronograph, 10 to 20 feet long.

Or suppose the lesson is on the general anatomy of the brain. Various dissections and preparations are made and photographed stereoscopically. The students can then see actual solid brain preparations, 20 feet in diameter. As the size of the human brain makes efficient instruction impossible to classes of more than twenty students, the gain is evident.

For the benefit of persons interested in psychology, I have gotten up two sets of ten views each which illustrate the laws of binocular or stereoscopic vision. With the lime light these can be made plain to audiences or classes of 200 persons; with the electric light, to an unlimited number.

My particular interest in the stereoscopic method lies, of course, in its pedagogical applications; but it is easy to foresee what it might do in the hands of a popular lecturer.

The Latest French Battleship.

The Charlemagne, which embodies the latest ideas of the French naval experts, presents many points of novelty over the existing ironclads of that nation. The main battery, which consists of four 11·81 inch guns, is placed in two 15¾ inch plated turrets, arranged as in our own Indiana on the fore and aft center line. The French custom of late years has been to place the large guns in four separate barbettes, arranged one on each beam, one forward and one aft. The Indiana system is less costly, lighter, and more convenient for the serving of ammunition in time of battle. The protection of the Charlemagne consists of a 15¾ inch belt that reaches 20 inches above the water line, above which is a 3 inch belt that is 3 feet wide, for the greater part of the ship's length, and is increased in width at the bows as a protection against end-on fire. She is relatively longer than her predecessor, being 385 feet in length, and her beam is less—67½ feet as against 73 feet.

This increased fineness in her lines will aid in securing the 18 knot speed that is anticipated. She will have three independent sets of engines driving three separate propellers, a system that has proved a great success in our own Minneapolis and Columbia. The secondary armament consists of ten 5½ inch quick fire guns, six 3¾ inch quick fire guns, sixteen 1·85 inch and eighteen 1·45 inch guns.

A Mechanical Horror.

Machinery is a monthly journal published at Johannesberg, South Africa. In the October number just received is an account of a most remarkable clock belonging to a Hindu prince, which the editor thinks the strangest piece of machinery in India. Near the dial of an ordinary-looking clock is a large gong hung on poles, while underneath, scattered on the ground, is a pile of artificial human skulls, ribs, legs, and arms, the whole number of bones in the pile being equal to the number of bones in twelve human skeletons. When the hands of the clock indicate the hour of 1, the number of bones needed to form a complete human skeleton come together with a snap; by some mechanical contrivance the skeleton springs up, seizes a mallet, and walking up to the gong, strikes one blow. This finished, it returns to the pile and again falls to pieces. When 2 o'clock, two skeletons get up, and strike, while at the hours of noon and midnight the entire heap springs up in the shape of twelve skeletons, and strikes, each one after the other, a blow on the gong, and then fall to pieces, as before.

THE WAR SHIP TEXAS.

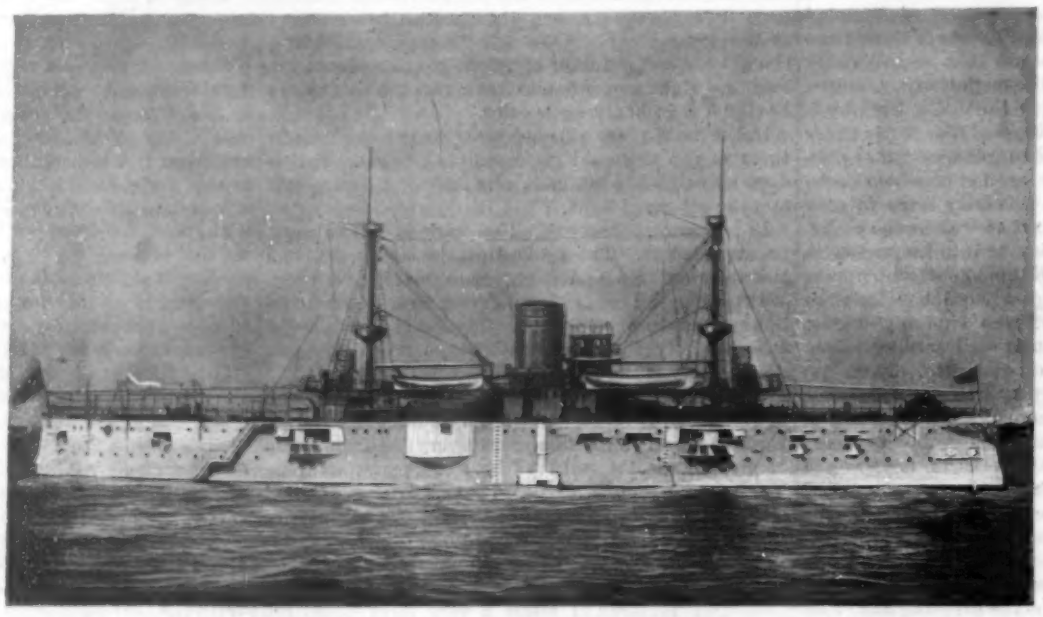
The United States second-class battle ship Texas was authorized by Congress in August, 1886. The designs were furnished by William John, of the Barrow Ship Building Works, but they were afterward considerably modified. It was built by the government at the Norfolk Navy Yard, and was launched June 28, 1892.

The Texas is a twin screw, steel armored vessel of 6,335 tons normal displacement. She is driven by two sets of triple expansion engines capable of developing 5,800 horse power with natural draught and 8,600 horse power with forced draught. The vessel is 290 feet in length and the beam is 64 feet 1 inch. It has a mean draught of 22 feet 6 inches and carries about 950 tons of coal. The main armament consists of two 12 inch breech-loading guns, each weighing 46½ tons, mounted in two turrets, one on either side of the forward deck. A secondary battery consists of four 6 pounder and four 3 pounder rapid-firing guns, with four 47 mm. Hotchkiss guns. All of these are mounted on the gun deck, with a 1½ inch plating to protect them. There are besides two Gatling guns and two 37 mm. Hotchkiss guns mounted on the bridge. The military tops and the flying bridge are provided with similar equipments.

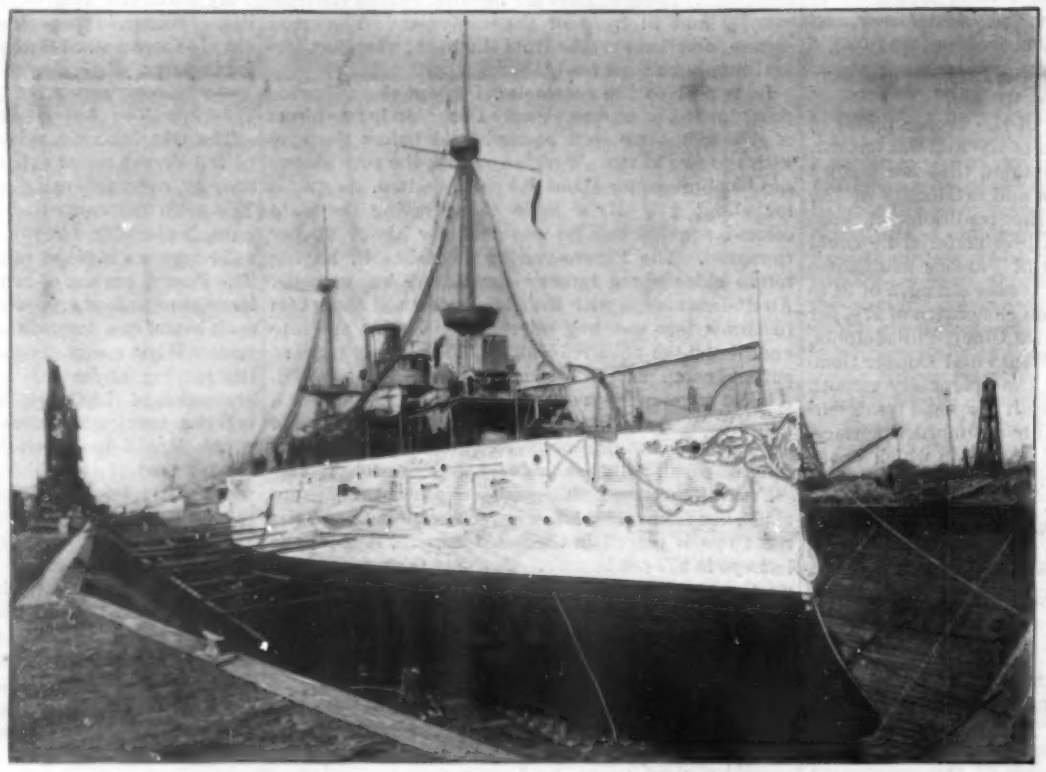
The turrets are armored with 12 inches of steel and their bases are inclosed by a diagonal redoubt armored with 12 inch steel plates, which serve to protect the hydraulic machinery used for operating the guns and the smoke pipe casings. The boilers and engines are protected by a nickel-steel belt of armor 12 inches thick, extending 2 feet above the designed water line and 4½ feet below it, having a length of 116 feet. There is a protective deck built of 12 inch steel above the armor belt. The hull of the Texas is built on the cellular system and is constructed throughout of steel. A double bottom extends under the engines, boilers and magazines and is divided into numerous watertight compartments by longitudinal and transverse partitions. There are in all 139 of these compartments, and all are connected to steam and hand pumps by an extensive drainage system.

It will be seen, therefore, that in the case of accident from rams or torpedoes, it will be practically impossible for the Texas to be sunk. The boilers and engines are placed in watertight compartments.

The ship is lighted throughout with electricity and carries two powerful electric search lights. She is to be used as a flagship and will be supplied with 368 officers and men. The machinery for the Texas has been built by the Richmond Locomotive and Machine Works, of Richmond, Va. There has been considerable criticism on the construction of the vessel, and in the opinion of many experts she is structurally weak; when the boilers were first filled, the weight of the water breaking the saddles which supported the boilers, and a bed plate of her auxiliary engine broke during the dock trial at Norfolk, the accident being caused, it was asserted, by the excessive flexibility of the hull. The Texas arrived at the port of New York from the Norfolk Navy Yard on October 23, and was taken to the Brooklyn Navy Yard a few days later. It was then found necessary to dock the ship, which had been continuously in the water since her armor, engines, and armament were added. It was feared that the dock at the Norfolk Navy Yard would prove inadequate for the safe dry docking of the vessel, so it was decided to put her in the timber dry dock in Brooklyn, where it was thought the tide was of sufficient height to safely float the vessel over the sill of the dock.



THE SECOND-CLASS BATTLE SHIP TEXAS.



THE BATTLE SHIP TEXAS, BROOKLYN DRY DOCK.

On the weekly inspection of the double bottoms of the Texas, on November 8, it was found that while no outward appearance gave evidence of a strain, some of the frames had become distorted apparently from the settling of the hull. Further examination showed that the cement was cracked in twenty or more sections along the ship's keel, that some of the plates had buckled from an inch to an inch and a half and the joints of the main drain and suction pipes had become strained. Water was at once let into the dock to decrease the strain on the vessel. The accident was said to have occurred to the Texas in a similar manner to that which happened to the Columbia when in the dry dock at Southampton, England. The exact cause of the accident will be determined by an official investigation. It has been intimated that in entering the dry dock the keel of the Texas had come in contact with the sill of the dock and that in so doing some of her frames had been strained. The great weight of the ship pressing upon the weakened frame as it rested on the keel block had developed a strain which was only relieved by the admittance of water into the dock. So far as details are concerned, extreme reticence has been maintained both at the Navy Department and in the Brooklyn Navy Yard. Our illustrations give a view of the battle ship and also a view of the ship in the dry dock at the navy yard, where the accident occurred.

How Cholera Was Suppressed in Honolulu.

An article in a recent number of the Independent, by Rev. Dr. Sereno Bishop, shows how perfectly controllable this fearful disease is when intelligent measures for its suppression are employed.

For three weeks the board of health, ably supported by the capable citizens and physicians, labored with the utmost energy and skill to subdue the growing epidemic. In spite of their best directed efforts it continued to increase and to appear in new localities. Although soon eradicated from Iwilei, where the first cases arose, four other centers of infection had been created. From one of these seventeen cases were taken, when the hamlet, somewhat isolated, was destroyed and the people removed. The cause of the failure of preventive measures became clear. Of the earlier sixty two cases, thirty-one were not reported to the health authorities until near death or after death. The more debased class of natives, among whom the disease chiefly prevailed, were in bondage to their witch doctors and dared not receive the aid of foreign physicians, who, as they were taught, were seeking to poison them. Under existing provisions it was impossible to get cholera cases reported in time to isolate exposed persons before they had scattered, or to make the necessary disinfection of the premises and excreta, or to disinfect or destroy clothing before it had been carried off or washed in neighboring streams. It made all the difference between suppression and wide conveyance of infection whether the officers heard of a case within six hours or not until twenty-four.

No amount of police vigilance or activity could reach this difficulty. Native superstition and prejudice erected itself as a fatal obstacle. In this strait a measure was devised which conquered the obstruction; it was a severe and despotic one, creating a strong and close guardianship over the persons and dwellings of every man, woman, and child in the city and district of Honolulu. The city was divided into twenty-one districts under chief inspectors, and these into 251 sections, each in charge of a sub-inspector, who twice a day visited every dwelling, and saw, or positively learned the condition of, every person belonging on the premises. These inspectors, if they saw reason, entered every room and examined every corner of the premises. Wealthy and well-to-do people cheerfully submitted to this invasion of privacy, for the sake of conquering the pestilence which threatened; there was, indeed, no resistance to it. This organized inspection went into operation on September 3, and lasted for fifteen days, although it had stamped out the epidemic in ten days. After it began, only four out of twenty-three cases failed to be promptly reported and thoroughly cared for in good time. In five days the cases had declined from seven to three a day, and in a week to an average of one a day.

The inspectors and sub-inspectors all worked very faithfully and without pay. The same was true of a sanitary committee of ten leading gentlemen to whom they reported, who labored night and day in aid of the board of health. In the infected districts inspectors had to use great vigilance. The determination was very strong to evade discovery. The deluded people thought it a matter of life and death. To be taken to the cholera hospital was certain death.

It is probable that a majority of the cases were persons of unsound health, belonging to the lower class of natives. We are made to realize what we had only remotely heard of, that Asiatic cholera is a disease of terrific malignancy and most rapid fatality. Happily, it is perhaps the most easily prevented of all the communicable diseases by well directed isolation and disinfection. It is not transported in the air and seldom is given by actual contact, if precautions of cleansing are used. As a rule, the germs enter the mouth directly in food or drink, and boiling heat destroys those germs.

THE AMERICAN SURETY BUILDING.

This imposing edifice, which stands on the corner of Pine Street and Broadway, is rapidly nearing completion, and it will be ready for occupation some time before the close of the year. With a total height from curbstone to coping of 314 feet, it can claim to be the loftiest inhabited building in the world. The Masonic building in Chicago is also over one hundred yards in height, if we reckon the roof stories; but the Surety building presents a finer architectural effect, owing to the fact that its front rises in a perpendicular line from the sidewalk to the massive top coping, above which there are no inharmonious roof lines projecting, to spoil the general symmetry of its appearance. The base line measures 84 feet 8 inches on Broadway, and 85 feet 6 inches on Pine Street, making a proportion of base to height of about 1 to 4. Strictly speaking, the Surety building is a colossal tower.

It is a skeleton frame structure; the outer walls being of brick, faced with dressed gray granite. The architectural treatment of the exterior is carried out on a bold and massive scale, the cornices being deep and heavy; and the bald, blank effect, which one would naturally expect in walls of this height, is altogether wanting. This is in a large measure due, we think, to the depth of the windows, resulting from the great thickness of the walls, which ranges from four feet in the lower one hundred feet of the building to two feet six inches at the top. Although covering an area only 85 feet square, the building contains over 400 rooms. They open into a central landing, through which pass the six elevators and a spiral stairway.

The roof is flat, and affords a promenade that is certainly unique. Leaning against the great granite blocks that form the coping, one can enjoy at leisure a panorama of rare interest and beauty; and it is certainly a novel sensation to look down upon the cross of Trinity steeple and the towers of Brooklyn Bridge.

By the courtesy of Mr. Bruce Price, the architect, we are enabled to present the chief details of the fireproof construction, as carried out in this building.

The interior columns are all protected with a thickness of 8½ inches of fire-brick "furring" and by the marble finish. The flooring is carried on 15 inch I beams, between which a flooring of 10 inch fireproof blocks is built. The blocks that are placed next the I beams have a thick flange that projects down and under the base of the beam, the two flanges meeting at the center of the base and completely covering it in. Below this is the ceiling plaster. Above the fireproof blocks are laid the 4 inch joists that carry the flooring, and the space between these is filled in with a special filling known as "ash concrete." This construction provides a solid floor of incombustible, non-conducting material that is 17 inches in thickness.

Throughout the whole building there is not a square inch of the steel framework that is exposed to the action of fire.

In regard to the risk of fire from the adjacent buildings, it was thought best to assume that the Schermerhorn building, though it is constructed as a first-class fireproof structure, might be the victim of a conflagration. Accordingly the walls on the south and east sides, which are adjacent to the Schermerhorn, are built up solid and 4 feet in thickness to a height of over 100 feet, the latter building being 110 feet high. This provides a protection of 2 feet of walling on the outside of the main columns—an amount that would give ample protection against the hottest fire.

The first line of windows above the adjacent building is furnished with iron shutters. It would have been better if the next ten stories had been so fitted. It is just here, if anywhere, that this fine building is vulnerable. The fire from the south side of Bleecker Street swept in through the windows of the Manhattan building, across the street. Iron shutters are unsightly, but they may prove the salvation of the building that carries them. The next best protection would be the furnishing of each window with asbestos curtains, such as are used between stage and auditorium in the theaters.

The Surety building carries 50,000 gallons of water for fire purposes stored in two large tanks; one on the twenty-first and one on the tenth story. Each floor is provided with 2½ inch portable hose.

There is one feature of the construction that is interesting, as showing how in these days the architect and the engineer are merging into one. The great bending strains that are set up in the framework of the building by the wind pressure necessitate the introduction of a system of lateral bracing. Every other story is stiffened in this way with diagonal ties and braces, which form a complete lateral truss across the width of the building in each direction.

THE NEW SURETY BUILDING, NEW YORK.

Powerful Dredge for the Mississippi River.

The Mississippi River Commission are the owners of the largest dredge in the world. The hull is 46 feet in beam by 140 feet in length. There are six diggers, which operate at the mouth of the intake of the suction pumps, and serve to loosen and break up the bed of the river sufficiently for the solid matter, sand, mud, gravel and so forth, to be drawn up and carried off by the discharge pipes. The pumping engines are of 1,200 horse power. The pumping capacity is 6,000,000 gallons of water an hour; and it is estimated that the dredge can handle twenty-seven cubic yards of sand in one minute. A good idea of its capacity for work can be gained from the statement of the New York Herald that "if it were possible to float it in New York's main thoroughfare, the Broadway tunnel could be dug at the rate of a mile and a half a month."

The Centenary of the Institute of France.

The centennial of the Institute of France was celebrated with great eclat. On the first day, November 23, a religious service was held in St. Germain des Près in memory of all members of the Institute deceased since its foundation, by Monseigneur Perraud, Bishop of Autun, a member of the Académie Française, and a very distinguished writer and philosopher.

On the next day (Thursday, 24th) a general meeting was held in the large hemicycle of the new Sorbonne, so splendidly decorated by the paintings of Puvis de Chavannes. The President of the French Republic was present with such ministers as were not professionally detained at the Chambre des Députés.

In the morning a short reception took place at the Elysée, where the President of the republic received the foreign members of the Institute. The foreign associates and correspondents to the number of fifty-five were presented to President Faure by the office bearers of their respective academies. The President welcomed them and held a short conversation with each.

In the evening a banquet took place at the Hotel Continental. Two hundred and fifty members were present. After two short "after-dinner" speeches by M. Ambroise Thomas and M. Poincaré, M. Max Muller, acting as spokesman for all the foreign members and associates, proposed the health of the Institute, "which, alone, remains unaltered and immovable in its renown and glory, while so many things have changed during this century," in very excellent terms. Most happily inspired was Lord Kelvin in his address. The very cordial and sympathetic expression which the Royal Society gave to its feelings in its address to the Institute was received with much satisfaction, and the few words which closed the orator's speech went to the heart of all Frenchmen: "Personally, I cannot express how much I appreciate the great honor you have done me in electing me among the associates of the Institute. But I owe to France an even greater debt. She has been, truly, the alma mater of my scientific youth, and has inspired my admiration for the beauty of science, which during my whole life has kept me chained in her service. It was Laplace who initiated me into celestial mechanics, and a few years later the venerable Biot led me by the hand and introduced me to Regnault's laboratory. To Regnault and Liouville I shall eternally be grateful for their kindness toward me, and for the solid teaching they gave me, in 1849, on experimental physics and mathematics. M. President of the Institute, gentlemen, I thank you with all my heart. From what I have said, you will understand why I consider with perfect gratefulness France as the alma mater of my scientific life." Great applause followed his speech.

The 25th was devoted to an afternoon in the Théâtre Français; in the evening a reception was held at the Elysée by the President. The last day was a visit to the magnificent residence of Chantilly, to the Duc d'Aumale, by special train, carrying 239 members, and at Chantilly eleven large vehicles transported the whole assembly to the chateau, through part of the woods, the race course, and the stables. The duke, who had hardly recovered from an attack of gout, had to receive his guests sitting in a rolling chair, and received them most cordially. The afternoon was devoted to inspection of the residence itself, which has been splendidly enlarged and embellished by the present proprietor, and to the surrounding grounds. The whole of Chantilly and of its contents has been bequeathed by the duke to the Institute. This represents nearly $10,000,000.

Earthworms.

BY C. F. MARSHALL, M.D., B.SC., F.R.C.S.

The common earthworm, despised by man and heedlessly trodden under foot, fulfills a part in nature that would seem incredible but for the facts revealed by the patient and long-continued researches of Darwin. "Worms," says Darwin, "have played a more important part in the history of the world than most persons would at first suppose." Let us follow Darwin, and see how this apparently insignificant creature has changed the face of nature. We will first consider the habits and mode of life of the earthworm. As every one knows, the worms live in burrows in the superficial layer of the ground. They can live anywhere in a layer of earth, provided it retains moisture, dry air being fatal to them. They can, on the other hand, exist submerged in water for several months. They live chiefly in the superficial mould less than a foot below the surface, but in long-continued dry weather and in very cold seasons they may burrow to a depth of eight feet. The burrows are lined by a thin layer of earth, voided by the worms, and end in small chambers in which they can turn round.

The burrows are formed partly by pushing away the earth, but chiefly by the earth being swallowed. Large quantities of earth are swallowed by the worms for the sake of the decomposing vegetable matter contained in it, on which they feed. The earth thus swallowed is voided in spiral heaps, forming the worm castings. In this case the worm obtains food and at the same time excavates its burrows.

In addition to the food thus obtained, half decayed leaves are dragged into the burrows, mainly for food, but also to plug the mouths of the burrows for the sake of protection. Worms are also fond of meat, especially fat; they will also eat the dead bodies of their relatives. They are nocturnal in habit, remaining, as a rule, in the burrows during the day and coming out to feed at night.

The leaves dragged into the burrows are moistened by a fluid secreted by the worm, of a digestive nature, and the food is thus partly digested before being swallowed. The digestive fluid of the earthworm resembles the pancreatic juice of higher animals, and only acts when alkaline. Various acids are produced by decaying vegetable matter, and similar changes occur in the leaves swallowed by worms. Now if some of this acid was not neutralized, digestion could not take place, because the digestive fluid is alkaline. This is avoided by the action of some small glands, called the calciferous glands, opening into the alimentary canal. These glands secrete carbonate of lime, which neutralizes the acids generated in the decaying leaves.

The earthworm has no eyes, but is affected by strong light, if exposed to it for some time. It has no sense of hearing, but is sensitive to the vibrations of sound. The whole body is sensitive to touch. There appears to be some sense of smell, but this is limited to certain articles of food, which are discovered by the worm when buried in earth, in preference to other bodies not relished. The worm appears to have some degree of intelligence from the way in which it draws the leaves into its burrows, always judging which is the best end to draw them in by. This is remarkable in so lowly organized an animal, being a degree of intelligence not possessed by many animals of more complex organization. For instance, the ant can often be seen dragging objects along transversely, instead of taking them the easiest way.

As we have seen, vast quantities of earth are continually being passed through the bodies of worms and voided on the surface as castings. When it is stated that the number of worms in an acre of ordinary land suitable for them to live in is fifty-three thousand, we can imagine the great effect which they must have on the soil. They are, in fact, continually plowing the land. At one part of the alimentary canal of the worm is a gizzard, or hard muscular organ, capable of grinding food into fine particles; it is this gizzard which is the main factor in triturating the soil, and it is aided by small stones swallowed with the earth, which act as mill stones.

The earth is thus continually passing through the mill formed by the gizzards of worms, and is reduced to fine mould. Again, from the collapsing of the old burrows the mould is in constant slow movement and its particles rubbed together. Fresh surfaces are thus exposed to the action of the carbonic acid in the soil and to the humus acids, agents which act in the destruction of stones and rocks. Moreover, the acids produced in the digestive tract of the worms are not all neutralized, for the castings have an acid reaction, and this acid acts further in the disintegration of rocks.

Thus all the mould covering a field passes every few hours through the bodies of worms, and the same fragments are probably swallowed and brought to the surface many times over in the course of centuries. Changes are also produced in the slopes of hills by the flowing down of moist castings and the rolling down of dry ones, thus reducing the slope of the hills by accumulations at the bottom. The castings are also blown repeatedly in one direction by the prevalent winds. Now as a layer of earth one-fifth of an inch thick, or ten tons by weight, has been calculated in many places to be brought annually to the surface per acre, if only a small part of this flows down every inclined surface, or is blown by the wind repeatedly in one direction, it is easy to see that a great change may be produced in the surface of the land in the course of ages.

In consequence of the immense amount of earth continually being brought to the surface by worms, it is not difficult to understand how objects, such as stones, rocks, etc., lying on the surface will in course of time become gradually buried in the ground. The worms, undermining the stones, bring up the earth to the surface, and so raise the ground round the edge of the stone till the latter sinks and is eventually buried in the soil, provided the soil is suitable for worms to live in. Darwin showed that in a field covered with flints of various sizes, the smaller ones disappeared in a few years, and in thirty years all had become buried, owing to the action of worms.

Owing to the burial of stones and other objects by the action of worms, ancient monuments, portions of Roman villas and other objects of antiquity have been preserved. These have been gradually buried by the worms, and so preserved from the destructive effect of rain and wind. Many Roman remains were studied by Darwin, and traces of the action of worms found, to which action their preservation was mainly due. The sinking of the foundations of many old buildings is due to the action of worms, and no building is safe from this unless the foundations are laid lower than the level at which the worms can work, viz., about eight feet below the surface.

Another useful effect produced by worms is the preparation of the soil for the growth of seedlings. By their agency the soil is periodically sifted and exposed to the air, and in this way is able to retain moisture and absorb soluble substances of use for the nutrition of plants.

Moreover, bones are buried by the castings and brought within reach of the roots of plants.

The earthworm is thus seen to be one of the best examples which show how "great effects from little causes spring." This unpleasant looking and slimy animal, before the days of Darwin, was looked upon as an entirely useless screature, except as a bait for fish and as food for birds.—Knowledge.

Extermination of the Buffalo.

The game of the West has rapidly disappeared before the huntsman's rifle. It is a fair estimate that four million buffaloes were killed within the five years between 1874 and 1879, from what was known as the Southern herd, which roamed through northern Texas, the Indian Territory, Kansas, and Nebraska. Between 1878 and 1883, the great Northern herd—quite as numerous—roaming through the Dakotas, Wyoming, and Montana, were destroyed in like manner. The hunters received on an average from $2.50 to $3.50 per hide, to be shipped out of the country and sold for leather making, belting, harness, and kindred purposes. Many thousands of men were engaged in the enterprise. The most successful hunting parties consisted of a hunter and about six men known as strippers. The time usually selected for taking the buffaloes was just after they had been grazing in the morning, had gone to the water and then returned to the high ground, lying down to rest in bunches of from twenty to a hundred. The hunter, with the longest range rifle of the heaviest caliber he could obtain, would fire from the leeward side, so far away that the crack of the rifle could not be heard by the buffalo, and being behind a bush or bunch of grass, could not be seen. In that way he would kill from a dozen to a hundred a day, without disturbing the herd to any great extent. The buffalo receiving a mortal wound would bleed to death, while the others about him, smelling the blood, would sometimes come near him and paw the ground, and so stand until they too would receive their death wounds. The strippers would then come up with ox teams, take off the hides, place them in the wagons, and transport them to the nearest railroad station, whence they were shipped to market. At one station alone on the Atchison, Topeka, and Santa Fe Railroad as many as 750,000 hides were shipped in one year.

After the hides were removed, the carcass would be poisoned in many cases, some yearling buffalo being generally selected, and next morning there might be found forty or fifty dead wolves lying scattered around, victims of strychnine. In this way large game was rapidly destroyed, together with countless numbers of wolves that had thrived only by preying upon them. This might seem like cruelty and wasteful extravagance, but the buffalo, like the Indian, stood in the way of civilization and the path of progress, and the decree had gone forth that they must give way. It was impossible to herd domestic stock in a country where they were constantly liable to be stampeded by the moving herds of wild animals. The same territory which a quarter of a century ago was supporting those vast herds of wild game is now sustaining millions of domestic animals which afford the food supply to hundreds of millions of people in civilized countries.—North American Review.

A Useful Principle in Invention.

We recently quoted in these columns, says the Literary Digest, an energetic protest against the too prevalent idea that the inventor does his work by the aid of a sort of divine afflatus—a heaven-given special faculty denied to other mortals. The author maintained that aptness in invention can be fostered and trained in the mind like any other quality, and advocated a special educational course to this end. Now comes Mr. Edward P. Thompson, who, in an article in the Journal of the Franklin Institute, entitled "Reversal in Invention," points out a simple fact that may be of the greatest use to future inventors, as it certainly would have been to inventors in the past. He reminds us that a large number of important devices may be sorted out into pairs, one of each pair being what he calls a "reversal" of the other. Thus the dynamo, which transforms mechanical into electric energy, on being reversed becomes the motor, which changes electric energy back again into the mechanical form. Now if this principle of reversal had only been recognized long ago, each of these pairs of inventions would have required but a single inventive act, instead of two entirely independent ones. Both the invention and its reversal would have been devised at once, instead of by different persons going through different trains of thought at widely different periods. We quote a few of Mr. Thompson's illustrations of these "reversed" inventions:

"At the time the microscope was invented the principle of reversal could have been applied by reasoning that, if a distant large object could be made to appear nearer, could not a near object be made to appear larger? Had this idea been created, the mechanical execution could have been carried out by experiments with lenses of different convexities, concavities, and numbers.

"A reversal of the telephone, which causes distant sounds to appear near, would be a microphone, but the present instrument is improperly named, as it does not enlarge but simply creates a sound. When first invented its wonderful power was spoken of as making the walking of a fly sound like thunder, but this is false, because the fly jarred loose carbon electric contacts, thereby causing great fluctuations of current and violent action of the receiving telephone. . . .

"The present air brake system is now recognizable as a reversal of the early type, but a long time passed before the change took place. The principle had not been used as a kind of tool, and, therefore, the idea of the new brake did not come by demand of the mind, but by a combination of circumstances, that is to say, accidentally. The two systems of brake referred to are perhaps already conjectured by the reader, the first operating to stop a train by the positive action of compressed air against the wheels through the medium of the usual brake shoes, and the second by the negative action of compressed air, which normally holds the shoes away from the wheels in opposition to a spring. The advantages of the second way are apparent as soon as compared as to their main object, safety; for by the former the train cannot be stopped in case of leak or a disordered pump, while with the latter the train stands still as soon as the air leaks out or the pumps refuse to work. . . .

"The mental process of investigating this subject makes the principle so simple that it is a wonder that inventions existed so long before their opposite phases were thought of. Electricity furnishes several examples besides the dynamo motor example, where the principle was not applied by a predetermined act. The old form of burglar alarm had an open circuit, and the process of opening the window closed the circuit and rang a bell. The reversal of this is a normally closed circuit. The opening of the window breaks the circuit and the bell rings. The idea once gained, and the advantages are apparent, for an alarm is given if the burglar cuts the wire. . . .

"The storage battery, although condemned for railway traction, is still one of the valuable inventions of the day, and is an exact reversal of the galvanic battery. The reversal is disclosed by stating that the operation of the primary or galvanic battery consisted in placing metal plates into a solution of salt or acid, and carrying off the electric current by a wire. The reverse of this consists in starting with an electric current, after the battery is partly exhausted, and passing the current through the solution in order to restore the chemicals to their original composition, ready to give off current as before the charging."

The Sawyer-Mann Patent Declared Invalid.

The United States Supreme Court decided, Nov. 11, the important case of the Consolidated Electric Light Company against the McKeesport Light Company in favor of the defendants. The court holds the Sawyer-Mann patent invalid. The decision was handed down by Judge Brown.

HANGING FERNERIES.

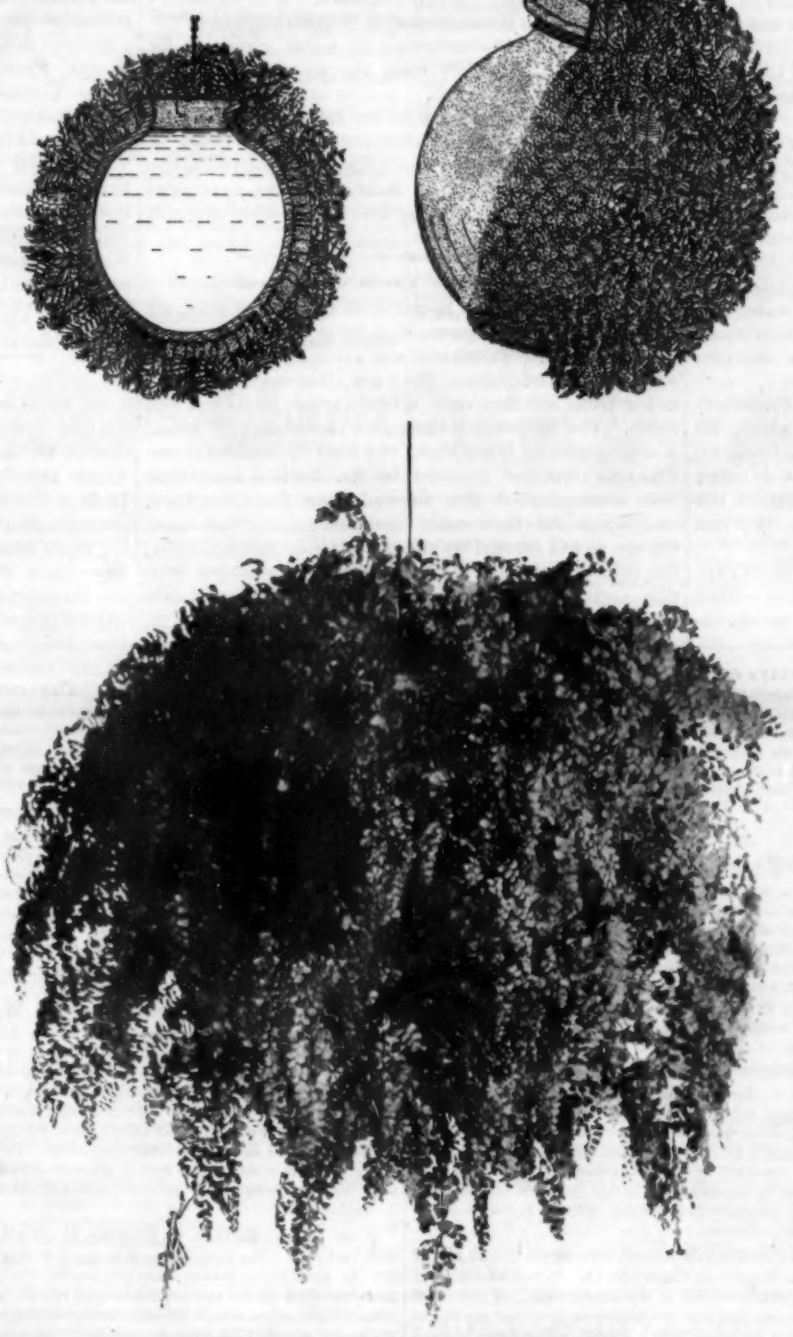
Mrs. G. P. Fitzgerald, of Duarte, Cal., has invented a new and most satisfactory method of growing ferns, both for outdoor and indoor decorations. Having studied the ferns of Southern California growing in their native canyons in such profusion and perfection, and noticing that the roots clung to the porous rocks with little or no covering except the moss and lichen growing round them, and seemingly drawing their sustenance alone from the water seeping through these rocks, she conceived the idea of artificially growing ferns in the same manner.

Having procured a two gallon earthen water vessel, known in Southern California as an olla, she made a mat of ferns, roots and moss large enough to entirely cover the vessel, which she secured around it, by means of wire netting, a wire handle being inserted at the top by which it was suspended. It was then filled with water, which, seeping through the porous vessel, caused the moss and ferns to grow naturally and luxuriantly, making a perfect ball of verdure.

The result of her efforts was so successful, and met with such general admiration, that Mrs. Fitzgerald determined to give to the world an invention which was the cause of so much delight to herself and her friends. She patented it, and is now selling her hanging ferneries as fast as she can manufacture them, the demand, even locally, being beyond her ability to supply.

The small figures in the accompanying illustrations show the construction, the larger view being from a photograph of a growing fernery. Wire netting of suitable size and shape is laid out on the ground, and upon it is placed a layer of about two inches of moss, roots uppermost, the ferns, from which the stems and leaves have been removed, being then placed roots uppermost on the moss, the roots being about four inches apart, and being sewed in place with wire or other suitable strands. An open-mouthed porous earthen vessel is then placed in the center of the mat thus formed, whose sides are drawn up around and shaped to the vessel, being fastened to the top by wires, and the vessel being suspended by a chain or cord.

The hanging ferneries can be made any size or shape required, and of all the smaller varieties of ferns, such as maidenhair. Once started they are permanent if never allowed to become dry. Mrs. Fitzgerald has ferneries now over a year old, that remained green through summer and winter, putting out young fronds all the time, it being only necessary to remove the old ones as they fade. For table decorations they are lovely and can be suspended from chandeliers or from stands made to support them, only, if gas is used, they should be removed immediately after meals to a more congenial atmosphere. The water seeping through the porous vessel drops slowly from time to time; hence it is necessary to keep growing plants or some vessel underneath to receive the water, or the fern ball can be emptied before placing over the table and filled again as soon as the meal is over, and placed where the dropping will do no damage. In greenhouses, windows, and for almost any house or veranda decoration they are very beautiful, and the small amount of care and attention they require is a great advantage; it is only imperative that the vessels should never remain empty, and it is therefore better that they should be filled with water every morning.



FITZGERALD'S HANGING FERNERIES.

What is Electricity?

That is a query often asked, but never answered with proof. Work says:

There are theories, many of them. It is evidently something of which we cannot take a part; we cannot cut a piece of it off and subject it to analysis; nor can we pour a little of it into a bottle, for future study and contemplation. It is like the wind, its effects can be measured; its force, strength, and quantity can now be calculated to a very nice degree. Still to liken it to the wind, it is a tremendous power, blowing, as it were, without moving, two ways at once along all parts of its path; giving off a halo of magnetism at right angles to that path everywhere. One of the nicest theories, perhaps, is the one that considers electricity a "condition" of atoms brought about by chemical action, as in a battery cell, or by what might be called a severe irritation of the magnetic halo, as in a dynamo; and by other means, such as heat and friction. What this condition is, is beyond us; it may be a violent rotation, or it may be an equally violent vibration of atoms; probably the arc light would prove it to be a vibration. But, as no man has seen an atom at any time, not even with the most powerful microscope, it is difficult to say. Friction in some form or other is present, as heat is produced before burning or destruction takes place. Even the filament of the best incandescent lamp falls to pieces; it can but work for a time.

Variable Star Clusters.

From Harvard College Observatory, circular No. 2, we learn that Professor Solon I. Bailey, in charge of the station at Arequipa, maintained by this observatory, has discovered from an examination of the photographs obtained by him of certain globular clusters that they contain an extraordinary number of variable stars. This is not a general condition of stellar clusters, however, for in others similarly examined by Professor Bailey no variable stars have been found. The photographs used in this discussion were taken at Arequipa with the 13 inch Boyden telescope. In the cluster in Canes Venatici, Messier 3 (N.G. C. 5,272), no less than eighty-seven stars have been proved to be variable from an examination of fifteen photographic plates. The change in every case is certain, and has been confirmed independently by Mrs. Fleming and the director, Dr. Edward C. Pickering, from an examination of six of these plates. Sometimes the variation amounts to two magnitudes or more, and sometimes it does not exceed half a magnitude on the plates which were used for its confirmation. No star was included in this count, if either of the three observers doubted the variation. Nine other stars were found to be variable by Mr. Bailey, but they are not included, since they did not show sufficient change on the plates used in confirmation. In like manner, from an examination of seventeen plates, Mr. Bailey found forty-six variables in the cluster Messier 5 (N.G.C. 5,904), which were confirmed on five plates. Fourteen other stars in this cluster are also probably variable, but have not yet been confirmed.

Cultivation of the Cocoanut.*

Soil and Climate.—A moist, tropical climate, with good and somewhat sandy soil, near the sea, is the best for the growth of the cocoanut palm. If the tide rises so that the sea may flow in daily over the plantation, so much the better, but drains must then be made, so as to allow the water to run off freely.

Sowing.—Ripe, dry nuts only should be used, and the very largest that can be obtained. Nuts for seed should be gathered from trees that are mature, but not too old, and kept dry for five or six weeks before planting. The nursery bed should be made under slight shade, such as that of the cocoanut palm; it should be thoroughly dug to a depth of two feet, and the soil well mixed up with ashes and coarse salt. At the beginning of the season's rains the nuts are put into this seed bed on their side, at a distance of one foot apart, and so that about two inches appear above the surface. The nursery bed should be kept damp, but not too wet. It is a good plan to transplant them into other beds at two feet apart when they are from two to six months old.

Transplanting.—When the seedlings are from six months to two years old they may be transplanted to their permanent positions in the plantation, at distances from each other of twenty feet. Pits should be dug for them, as large as three feet every way in poor soil; ashes and salt are useful additions to any soil, and it may be necessary to give also a top dressing of manure, which should not be dug in. They should be shaded by bananas or plantains for two years.

Tillage and Manuring.—The Jamaica nuts are very small, and do not give much "meat" as compared with those from Central America, India and Ceylon. This may be due partly to unfavorable conditions of soil, climate, etc., but much might be done to improve the fruit by careful selection of nuts for seed, and a liberal treatment of the trees in the plantation by tillage and manuring. It is calculated that in India there are 480,000 acres under the cocoanut, and the cultivation is attended to carefully. In Bombay, for instance, after the seedlings are planted out, they are watered every day or two for the first year, every two or three days for the second and third years, and every third day for the fourth and fifth years. "During the rains, from its fifth to its tenth year, a ditch is dug round the palm and its roots cut, and little sand banks are raised round the tree to keep the rain water from running off. In the ditch round the tree, 22 pounds of powdered dry fish manure is sprinkled and covered with earth, and watered, if there is no rain at the time. Besides fish manure, the palms get salt mud covered with the leaves of the croton oil plant, and after five or six days with a layer of earth; or they get a mixture of cow dung and wood ashes covered with earth, or night soil, which, on the whole, is the best manure." (Watt's Dict.)

In the tropics of the old world generally it is customary, when the plant is one year old, to dig round the roots and apply ashes once a month; when the tree is two years old, to open up every year, at the beginning of the rains, the roots to a distance of four to six feet from the stem, to apply ashes and dry manure to the roots, and leave the opening until the end of the rainy season; then to fill in again the soil which has been removed, and level the ground. During the time the roots are exposed, the older worn-out rootlets may be cut away and the roots of other plants removed. Cattle should on no account be allowed in the plantation, as it is most hurtful to the tree to have the leaves bitten, and if the unfolded leaf is injured the tree dies.

Yield.—A tree in good condition yields from fifty to one hundred nuts every year, but good climate, soil and cultivation may bring the yield up to as many as two hundred nuts.—American Journal Pharmacy.

A Whistling Eel.

Capt. Luther D. Burnett is authority for the story that a remarkable eel, fully fifteen feet long, was seen in Mecox Bay, L. I., Nov. 11. The captain says it was as large around as an ordinary nail keg. Capt. Burnett's attention was attracted to it by a hissing sound. He was fishing, and, turning his head, he saw the eel traveling on top of the water. After uttering a shrill whistle, the monster disappeared from view.

*From the Bulletin of the Botanical Department, Jamaica, 3, 188.

Water Supply of Rome.

At a recent meeting of the Engineers' Club, of Philadelphia, the paper of the evening, on the above subject, was presented by Dr. Henry Leffman.

The best information on this subject can be obtained from the work of Sextus Julius Frontinus, who was Water Commissioner of Rome from about 94 to 97 A. D. The most satisfactory manuscript was discovered about 1400 in the Benedictine convent of Monte Cassino, near Naples, where it still remains, and copies of it were published in Latin in 1788, while a conjoint French and Latin text was issued a few years ago. Mr. Clemens Herschel promises a complete edition in English, which would certainly be a valuable contribution to the history of engineering.

Up to 310 B. C. the citizens of Rome were supplied with water from the Tiber or from wells and springs. In Frontinus' day, nine aqueducts were in active use, which in the order of their construction were the Appian, the old Anio, the Marcian, the Tepula, the Julia, the Virgin, the Alsietina, also called Augusta, the Claudian, and the new Anio. The first named was built by Appius Claudius Crassus, the builder of the famous Appian Way. The aqueduct Marcia was built with an appropriation which would probably correspond, at the comparative price of labor and the value of money, to about $2,000,000, and it is still one of the best sources of supply for the city of Rome.

Regarding the quantity of water that was delivered to Rome, at the end of the first century, Mr. Herschel finds that assuming a population of 1,000,000, the daily quota was 50 gallons per person, which includes the stealing of the water, that was a common practice at that time. There were four classes of recipients, the 19 barracks, 95 public buildings, 39 places of amusement and 591 open reservoirs or fountains. The water was distributed in some of the houses by lead pipes, made by folding over sheet lead, and joining the margins with a solder of pure lead.

The total length of all the water channels constructed within four centuries was 271 miles, of which 230 miles were under the surface, the remainder being on substructures, generally arched. The channels were of various shapes, generally rectangular, that of the Marcian aqueduct being 4 feet 10 inches high by 2 feet 5 inches wide, with walls 11½ inches thick.

Regarding the chemical character of the waters supplied, we only know that they were mostly rather hard, and that those derived from streams were subject to turbidity from storms. The water of the Virgo aqueduct seems to have been among the purest, while that supplied by the Alsietina was not very wholesome. It was chiefly used, however, for supplying the place where the sham sea fights were held, the surplus being distributed for irrigation. Although there was no means of filtration in use, since the sources of supply were generally pure, and there were no dangers of contamination in transit to the city, the Romans of that time enjoyed a system built upon the same type as that lately adopted for the supply of the largest city of this continent.

The base of the channel in the aqueducts was often broken by inequalities or dips, as if to promote aeration and catch suspended particles, and in some cases special interrupting reservoirs of interesting construction were added. A double or rather a manifold supply was instituted by Trajan, in which the various waters were classified according to their value for different purposes. Under this system the Marcia supply, being the purest and coldest, was reserved for drinking, while the old Anio was used for sprinkling gardens and similar inferior purposes.

It is a mistake to suppose that Roman engineers did not understand the principle of water rising to its reservoir level, for they used the so-called inverted siphon in their aqueducts.

At the close of his remarks Dr. Leffman exhibited a series of lantern slides, showing exterior views of the remains of some of the principal aqueducts, the shapes of cross section of their channels, a map of Rome showing the courses by which they were brought to the city, etc.

The Glow Worm Caves of Tasmania.

At a meeting of the Royal Society of Tasmania, an account of some fine caves that have been discovered near Southport, Tasmania, was given by a Mr. Morton, who had visited them. They are situated about four miles from Ida Bay, and a fairly good road leads to them. The entrance is through a limestone formation. A strong stream flows along the floor of the chambers. The first chamber reached by Mr. Morton and those who accompanied him showed some fine stalactites, and along the floor some fine stalagmites were seen. On the lights carried by the party being extinguished, the ceiling and sides of the caves seemed studded with diamonds—an effect due to millions of glow worms hanging to the sides of the walls and from the ceilings. Further on several chambers were explored, each revealing grander sights. The time at disposal being limited, the party had to return after traversing a distance of about three-quarters of a mile, but from what was observed the caves evidently extended a distance of three or four miles. The only living creatures seen were the glow worms.

The American Society of Mechanical Engineers.

The sixteenth annual meeting of the American Society of Mechanical Engineers will be held at the Society's parlors, 12 West Thirty-first Street, New York City, December 3 to 6. A number of professional papers will be presented by members, the reading of which will be followed by discussions. On December 6 a reception and conversazione will be held for members and their ladies at Delmonico's. A part of each day has been left free, so that out of town members may have an opportunity of visiting the interesting institutions and engineering works in the vicinity. Cards of admission have been provided to each of the seventeen places of interest, and each card gives full directions for reaching it. The various institutions and establishments to be visited are as follows:

Morgan & Quintard Iron Works, North River Iron Works, Pond Machine Tool Works, Stevens Institute of Technology; Columbia College: School of Arts, Law, Mines; Columbia College: School of Medicine (College of Physicians and Surgeons); Pratt Institute; Washington Bridge; Ship Yards and Works: S. L. Moore & Sons Company; World Building, Equitable Building, Metropolitan Museum of Art, Museum of Natural History, East River Gas Works, Ball & Wood Engine Company, Power House Broadway cable road, Power House One Hundred and Twenty-fifth Street cable road; Eastern Power House, Brooklyn City Railroad.

A Record Breaking Run.

On Thursday, October 24, all long distance records for high speeds were broken by a special train of three cars on the Lake Shore & Michigan Southern Railway, which ran from One Hundredth Street, Chicago, to Buffalo Creek, 510·1 miles, in 8 hours 1 minute and 7 seconds, or at the rate of 63·614 miles per hour including stops and at 65·07 miles per hour deducting stops. The train consisted of engine and tender, weight 200,000 pounds, and three drawing room cars, weight 300,000 pounds; total, 500,000 pounds.

RECENTLY PATENTED INVENTIONS.

Railway Appliances.

CAR COUPLING.—Andrus S. Weaver, Newark, N. Y. This coupling is of the type having a swinging knuckle, and has a strong yet simple locking means which is automatic in its action. The coupling is designed to withstand the rough usage of heavily loaded cars, and the top and bottom walls of the head are preferably made quite thick.

RAILROAD CROSSING GATE.—Elliott Preston, Sturgeon, Mo. This improvement is designed to prevent stock from crossing or traveling along a railroad, while not offering any obstruction to the passage of a train, there being means for controlling the gates from the train at some distance up and down the track. Rock shafts journaled beneath the rails are arranged to operate crank arms as the train approaches, and connecting rods unite the shafts with gates mounted to swing over the track or in transverse alignment, springs restoring the bars to their normal position after the passage of a train.

RAILROAD TIE.—Robert A. Maasfield, Beaver, Texas. This is an improvement upon a formerly patented metallic tie, to strengthen it and reduce the cost of manufacture. The tie is T-shaped in cross section, and is provided with clamping jaws having flat abutting inner faces, one jaw of each set being secured to the tie, which has a base extending beyond the inner and outer faces of the jaws. The opposing jaw of the set slides on the fixed jaw, and both jaws have recesses at the upper ends of their inner faces for the reception of the flange of the rail, bolts extending through to hold the jaws together.

INSULATING RAILS.—Francis W. Wilson, New York City. This invention provides an insulating base plate of greater width than the rail base, and having at its opposite side openings extending inwardly to the line of the rail base, insulating side pieces as wide as the openings being made to extend into them and upwardly and inwardly over the rail base. The insulated rail is thus firmly held to its supporting base, the insulating devices not moving either longitudinally or transversely

Mechanical.

WEIGHT MOTOR.—John G. Ball, Chesterville, Ohio. This is an improvement on a formerly patented invention of the same inventor, providing for putting successively in action a series of weights, to insure the running of the motor for a considerable time without rewinding. Weighted chains are passed around sprocket wheels on a shaft, and a tripping shaft has arms engaging a link of one of the chains, a pivoted lever connected with the other chain engaging an arm of the tripping shaft to lock it. Any number of the devices may be connected, so that one weight chain, nearing its run-down position, releases the next succeeding wound-up chain to insure continuous running of the shaft.

FORMING SEAMLESS TUBES.—Johann Georgen, Jacob Reiff, and Reinold Kempin, Kewanee, Ill. A machine for forming solid metallic blanks into seamless tubes, devised by these inventors, consists principally of cylindrical drawing rollers, each formed with a threaded end adapted to engage the blank and draw it forward over the mandrel and between the smooth surfaces of the rolls. The same rolls serve to produce the pipe and to finish it, and the machine is of very simple and durable construction.

Agricultural.

PLOW PROTECTOR.—Zachariah F. Jones, Scottsville, Va. To facilitate removing a plow from point to point, without danger of breaking the plow point or share, this inventor has devised a runner by which the plow is held in upright position and may be moved easily over the ground. It is made of strip iron or steel, its upturned forward end clamping the plow point, while its upturned rear end has slotted seats for clamping wedges, to be employed in attaching the runner to plows of unusual pattern.

FEED GRINDING MECHANISM.—William J. Harper, Wauseon, Ohio. This is a mechanism adapted to be readily connected with an ordinary windmill, to be operated by the reciprocating movement of the pump rod, with which the movable grinding jaws are so connected as to be automatically moved out of a grinding position when the rod moves in one direction and into a grinding position when it moves in an opposite direction.

DUMPING WAGON.—George Stailey and Wm. Snyder, St. Martinville, La. In four-wheeled farm wagons, according to this improvement, the front bolster and rear axle are connected by arched reaches, to which the wagon body is hinged. Fixed and movable stops and supports are also provided for holding the wagon body in normal or horizontal position, a hinged device being employed for raising and locking the movable stops.

POULTRY KILLER.—Charles K. Olson, Red Wing, Minn. This is a simple, inexpensive machine, to be worked by hand or foot, by which poultry may be killed as expeditiously and painlessly as possible.

Miscellaneous.

BICYCLE.—Count Detalmo di Brazza Savorgnan, Rome, Italy, and Hotel Savoy, New York City. In this machine the pedals for propelling the drive wheels are oscillated in a vertical plane, to give the feet a natural movement practically the same as walking. This is effected by means of one or more slotted cams connected with the drive wheel hub by gearing. The machine is capable of carrying two or more persons, and may be changed from a foot-propelled to a hand-propelled machine, having also novel features in its steering mechanism and other details of construction.

BICYCLE DRIVING GEAR.—Arthur O. Collier, Manchester, England. This is an improved two-speed driving mechanism, comprising a pedal shaft journaled eccentrically in a hollow axle upon which is journaled a sprocket wheel, a bolt locking the axle to the frame to form a stationary bearing for pedal shaft and sprocket wheel, or locking the axle to the pedal shaft so that it revolves therewith and with the sprocket wheel. An internal toothed wheel on the pedal shaft and an external toothed pinion on the sprocket wheel mesh and run as gear wheels when the mechanism is geared up for speed, and engage as clutches when the mechanism is geared down for power.

PHOTOGRAPHIC PRINT MOUNTER.—Thomas Bevan, Essex, Ill. This is a simple and durable, easily manipulated device, to facilitate the accurate placing and rolling of the print on the cardboard. It comprises two plates hinged together, one adapted to receive the cardboard and the other the print, and a roller carried by one plate is adapted to roll over the other plate upon raising or lowering the top plate. The connection permits the use of thin and thick cardboard on the same device.

MUSIC LEAF TURNER.—Leonard H. Wood, East Orange, N. J. The body casing of this device is preferably of sheet metal, and within it is an inner tubular casing containing nested pivoted tubes of graduated diameter, the sheet-carrying arms being secured to the tubes, while there is a pin and slot connection between the several tubes and a sleeve, by which the tubes are turned as the sleeve is raised or lowered. The device is for use in connection with a piano or similar instrument, or a music stand, and may be operated either by hand or foot.

GAS REGULATOR.—Frank E. Vail, New York City. This improvement is designed to regulate the pressure, to prevent waste and insure a steady flame, and the regulator has two diaphragms, one to be brought into action should the other become defective. Means are provided for steadying the valve to prevent flickering at the burner, and the upper diaphragm does not interfere with the action of the lower one, which directly controls the gas. The diaphragms are preferably composed of thin, highly flexible vulcanized fiber.

MEDICATED VENTILATOR.—Alfred C. Stevenson, Oakdale Station, Pa. This improvement comprises a perforated box with supporting cleats, and grooves for the sash cord, adapted to be applied to any ordinary window to prevent dust or germs from being carried into the room. In the box is a screen, and when desired a suitable medicament or antiseptic, such as turpentine, beechwood creosote, carbolic acid, etc., may be placed in the box, the vapor therefrom mingling with the atmospheric air which passes into the room.

TREATING MINERAL PITCH.—Harvey L. Sellers and Hugh R. Conyngton, of New Orleans, La., and Thomas Conyngton, of Fort Worth, Texas. These inventors have devised a method of and apparatus for readily separating asphalt and asphalt oils from sand, bituminous rock, and other impurities. The material is subjected to the action of hot water, to disintegrate it, when the asphalt and oil rise to the surface and the sand and impurities sink to the bottom, whence they are removed by an independent current of water or other mechanical means.

FLUID SCREENING DEVICE.—James Patterson, Williamstown, West Va., and Michael B. Carmody, Marietta, Ohio. This improvement is for use in pipes or mains conducting natural gas, water, oil, and other liquids, to intercept solid matter and other impurities and facilitate their ready removal. A cylindrical or spherical casing is arranged in the main pipe, and in the casing a screen is supported at an angle of about forty-five degrees by transverse bars, the screen being introduced through a cap-closed opening at the top of the casing. The lower part of the screen discharges into a bottom recess, where there is a draw-off cock to remove solid matter or other impurities.

ADDRESSING MACHINE.—Emil Meier and Henry A. Landman, Brooklyn, N. Y. This is a machine adapted to print from linotypes, and especially designed to print envelopes, wrappers, etc., on which addresses are usually written. It has an efficient gripping mechanism to hold the linotypes while in use, a simple feed mechanism to carry the envelopes or other blanks through the machine, an automatic feed delivering the linotypes successively to the grippers on the printing cylinder, with efficient means for ejecting them after use, where they may be quickly taken up and rearranged for further work. The machine is adapted to print rapidly and well.

SELF-CLOSING FAUCET.—James J. Gannon, New York City. This is a simple and inexpensive self-closing faucet, which has its valve pressed normally into closed position by the pressure of the liquid within, a simple cam mechanism moving the valve against the tension of its spring to open the faucet. The valve has a spring-pressed stem with a cam on its end, and a forked handle turning in the casing has in its ends sockets to receive bearing balls riding on the cam.

COAL WAGON UNLOADING ATTACHMENT.—Samuel H. Casselberry and James B. Rapp, Collegeville, Pa. These inventors have devised a wagon of such construction that it may be drawn up sidewise to the curb and the coal discharged therefrom in the direction of either of its sides, and to any point within reasonable reach. An elevator adapted to be operated by a crank at the side extends up within the body of the wagon, and the scoops or buckets of the elevator dump the raised coal into a chute made in telescopic sections, the outer hinged tubular section of the chute being adapted to pass vertically into the sidewalk opening of a coal vault.

KING BOLT PLATE.—Edward Clark, New York City. This improvement is more especially designed for heavy wagons and trucks, reducing the friction to a minimum and permitting the ready removal of worn contacting parts and their replacement. A bottom plate has a central hub and in its top surface is an annular groove of semicircular cross section, a bolster receiving plate with a central aperture receiving the hub and having at its under side an annular bead fitted into the recess.

VEHICLE HUB SAND BAND.—Harry W. Russell and Stephen Van Riper, Dowagiac, Mich. This improvement comprises a ring-shaped section screwing upon a straddling section, a wedge engaging the straddling section, the axle and the ring-shaped section, to fasten the parts in position on the axle. The sand band is in the form of a disk made in sections, of which one

straddles the axle and the other is slidable to fasten the disk in place on the axle.

EXTRACTING METALS FROM THEIR ORES.—John A. Keating and Frederick A. C. Amcotts, Radersburg, Montana. For extracting gold and silver from their ores, especially from pyritic or other refractory ores, these inventors have devised a process which consists in comminuting the ores in the presence of quicksilver in a solution of acetic acid or its equivalent, drawing the solution into a settling tank and standardizing it for use again, then flowing off by clear water the lighter portions of the pulp, finally removing the heavy pulp and completing the amalgamation and recovery of the precious metals contained therein.

PACK SADDLE.—Abraham A. Anderson, New York City. According to this improvement an arm is projected from each side of an A-shaped frame and two straps are secured to each arm, one of each pair of straps being extended across from one arm to the other and the remaining straps being extended downwardly to the lower end of each frame. The saddle is designed to fit well to the back of the animal, and to have readily removable receptacles to receive packages of any description, there being also a space at the center of the saddle where articles may be conveniently packed.

FEED BAG VENTILATOR.—John H. H. Burge, Brooklyn, N. Y. In each side of the front of the bag, in position to rest against the animal's cheeks, is affixed a semispherical perforated ventilator whose flat surface, lying against the inner side of the bag, has a central opening and outwardly projecting threaded boss engaged by a locking collar, to clamp the ventilator in place.

NURSING BOTTLE PROTECTOR.—Frank G. Presnell, Chillicothe, Ohio. This device is made of rubber or equivalent material, and consists of a jacket or sleeve which may be readily placed upon the bottle, the sleeve being corrugated and having vent openings in its exterior channeled portions preventing the breaking of the bottle by its coming in contact with a hard body.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

SCIENTIFIC AMERICAN BUILDING EDITION.

NOVEMBER, 1895.—(No. 121.)

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1. An elegant residence at Wakefield, N. Y. Two perspective elevations, also an interior view and floor plans. Mr. Ralph N. Cranford, architect, Wakefield, N. Y. An excellent design.
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3. A double house at Marietta, Ohio, recently erected at a cost of $2,163. Three perspective elevations and floor plans. William Foreman, architect, Marietta, Ohio.
4. A residence at Germantown, Philadelphia, recently erected at a cost of $35,000 complete, including stable. Perspective elevation and floor plans. Architects, Messrs. Hazlehurst & Huckel, Philadelphia, Pa. An ornate residence in the Spanish Renaissance style.
5. A residence at Lake Waccabuc, N. Y. Two perspective elevations and floor plans. An attractive design.
6. A Reformed Dutch Church at Warwick, N. Y. Three perspective elevations and floor plans. Cost $30,000. Architect, Mr. E. G. W. Dietrich, New York. A design successfully treated in the Byzantine style.
7. A cottage at Mount Vernon, N. Y., recently erected at a cost of $2,500. Two perspective elevations and floor plans. Architect, Mr. A. M. Jenks, Mount Vernon, N. Y.
8. Perspective elevations of two low cost houses located at Hasbrouck Heights, N. J. Perspective elevations and floor plans. Cost, $1,850. Mr. S. A. Dennis, architect, Arlington, N. J.
9. Views and floor plans of two windmills, at Mount Vernon and Wakefield, N. Y. Cost complete, $1,900. Architect, Mr. Frank M. Wright, Mount Vernon, N. Y.
10. A stable at Wakefield, N. Y. Perspective elevation and floor plans. Architect, Mr. Ralph N. Cranford, Wakefield, N. Y. An original design.
11. Miscellaneous Contents: Hints to readers.—The education of customers.—The echo organ at Westminster Abbey.—The Mascot heater, illustrated.—Carlisle's burglar proof window sash lock, illustrated.—Steam pipe and boiler covering, illustrated.—A large shipment of roofing slate.—Moving a masonry house.—The "Royal" door check and spring, illustrated.—An improved window screen and awning, illustrated.—An improved steam heating boiler, illustrated.—Improved woodworking machinery, illustrated.—Painting iron work.—A new and powerful elevator, illustrated.—Cheap flour or middlings in paint.

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The best book for electricians and beginners in electricity is "Experimental Science," by Geo. M. Hopkins. By mail, $4; Munn & Co., publishers, 361 Broadway, N. Y.

Denney's Divided Car Axle.—See illustration and description on page 335. The inventor of this axle desires to form a syndicate to make all negotiations with railroad companies in the United States and foreign countries for the use of these axles. He will furnish all axles required for testing their efficiency and durability. Address S. L. Denney, 2435 Atlantic Avenue, Atlantic City, N. J.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.
Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.
Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(6660) A. H. H. & Co. ask for formulas for rubber stamp ink. A. The usual rubber stamp inks are prepared with water-soluble aniline colors and glycerine.

1. Blue rubber stamp ink:

Aniline blue, water sol., 1 B	3 parts.
Distilled water	10 "
Pyroligneous acid	10 "
Alcohol	10 "
Glycerine	70 "

Mix them intimately by trituration in a mortar. [The blue should be well rubbed down with the water, and the glycerine gradually added. When solution is effected the other ingredients are added.] Other colors are produced by substituting for the blue any one of the following:

2. Methyl violet, 3 B	3 parts.
3. Diamond fuchsin I	2 "
4. Methyl green, yellowish	4 "
5. Vesuvin B (brown)	5 "
6. Nigrosin W (blue black)	4 "

(6661) F. S. E. asks: Will you please explain how such animals as cats, owls and bats, and other birds, can see at night? If the night is pitch dark and no ray of light strikes their retina, yet they can see. What is the principle on which vision is granted them? A. The pupils of the eyes of night roving animals and birds have a much larger aperture in proportion to their focal length than in the human eye. The light grasping power as indicated by the angular opening is therefore much greater than in the human eye, which enables the optic nerves to define objects which otherwise would be indistinct or not observable. There is also a possibility that a higher optic nerve power may be developed by habitual work in darkness. This is known to take place in the eyes of persons working in mines or dark places. No animal can see in absolute darkness.

(6662) D. McC. writes: Query 6642 has met with disfavor in the Michigan mining school and also the high school here in Houghton, and I have been requested to ask the following, to be answered in your columns: 1. If energy was not put in the spiral spring when wound up, what was put in? A. As stated, heat energy is put into the spring when wound, which heat energy, under ordinary circumstances, at once disappears. 2. If the spiral spring is wound up, tied, and heated red hot till the temper is taken out, where then has the energy gone? A. The heat energy, if the spring stands a few minutes, is, by radiation and conduction, distributed through the air, so that the coiled spring is in the condition alluded to in the last sentence of answer to query 6642, i. e., of having "no energy imparted to it by such winding."

NEW BOOKS AND PUBLICATIONS.

SOUVENIR OF THE UNIVERSITY OF MICHIGAN. Edited and published by George E. Frazer and William A. Mogk, at Ann Arbor, Michigan.

Contains articles by representative men of the university and is profusely illustrated with views of the great western university.

THE SPLASH OF A DROP. By A. M. Worthington, M.A., F.R.S. London: Society for Promoting Christian Knowledge. 1895. Pp. 76, 16mo. Price 60 cents.

This is a reprint of a discourse delivered at the Royal Institution of Great Britain on May 18, 1894. The book is illustrated with a series of interesting photographs of the splash of drops of various substances. It is an interesting study in physics.

ELEMENTARY PHYSICAL GEOGRAPHY. By Ralph S. Tarr, B.S., F.G.S.A. New York: Macmillan & Company. 1895. Pp. 488, 12mo, 267 illustrations. Price $1.40.

The author is professor of dynamic geology and physical geography at Cornell University, and is the author of "Economic Geology of the United States." A new text book on physical geography has been wanted for a long time, a book which should not reproduce the time-honored illustrations of Sir Charles Lyell and Sir Henry de la Beche. In the present work the selection of illustrations is most admirable, the greater portion of them being reproduced from photographs by the half tone process. Some of them are, however, too small to be of much value. The many diagrams are also excellent. The facts are presented in a clear and logical manner and would prove entertaining to even the unscientific reader. The book is very attractively got up. The author announces that this book is based upon the manuscript of another and more advanced work, which is soon to be published as a handbook for teachers and for reference. It is to be hoped that the author will still adhere to the plan of illustrating it by means of photo-engravings made from photographs.

EXCELSIOR ENGLISH-SPANISH AND SPANISH-ENGLISH DICTIONARY. Commercial and technical. By A. M. A. Beale. New York: Excelsior Publishing House. 1895. Pp. 656, 16mo, double indexed, red and yellow edged, full russia leather. Price $2.

The constantly increasing volume of trade between the United States and Spanish America has developed the need of a dictionary embracing both languages which gives the technical or trade names of articles of merchandise in addition to those words used in ordinary intercourse. The Spanish language, while refined in character, is poor in terms used in the mechanical arts. To a large extent Spanish equivalents are borrowed from the English, but with a change in spelling or accentuation sufficient to disguise them effectually. The prime object of this work has been to give the business man a dictionary which will fill the wants of his trade. While admirable in many ways, the book contains many misspelled words.

PHOTOGRAMS OF '95. A pictorial and literal record of the best photographic work of the year. London: Dawbarn & Ward, Limited. 1895. Pp. 104, 8vo, profusely illustrated. Price 80 cents.

This work is compiled by the editors and staff of the Photogram. It is a unique collection of some of the best photographic work of the year, the illustrations being all half tones. In addition to figure pieces, portraits, etc., some of the picturesque bits of old England are reproduced. The pictures of London especially are very beautiful, showing the peculiarly artistic effect caused by the smoke and fog.

TO INVENTORS.

An experience of nearly fifty years, and the preparation of more than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. A synopsis of the patent laws of the United States and all foreign countries may be had on application, and persons contemplating the securing of patents, either at home or abroad, are invited to write to this office for prices, which are low, in accordance with the times and our extensive facilities for conducting the business. Address MUNN & CO., office SCIENTIFIC AMERICAN, 361 Broadway, New York.

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November 12, 1895,

AND EACH BEARING THAT DATE.

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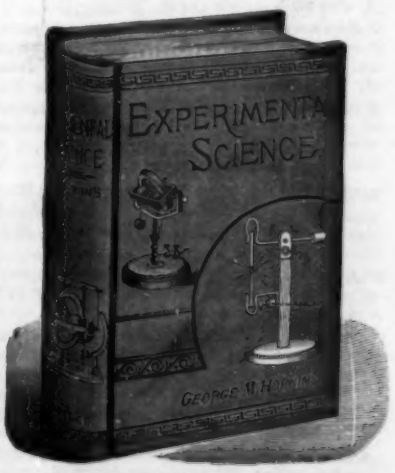

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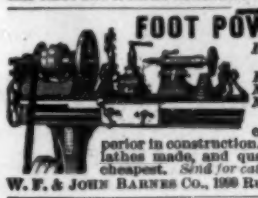

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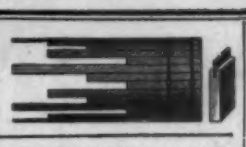

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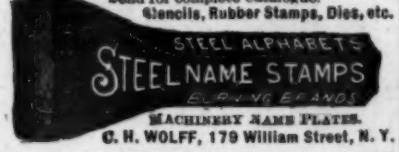

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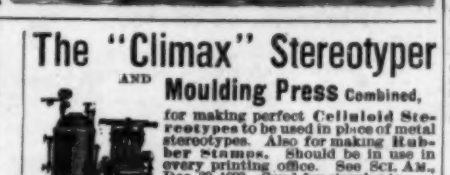

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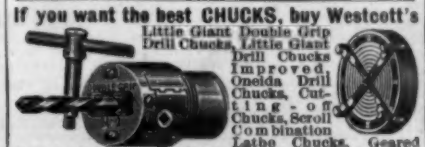

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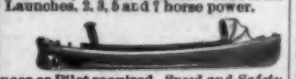

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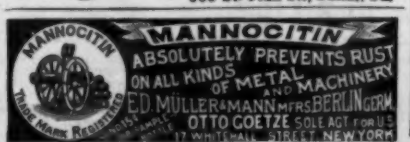
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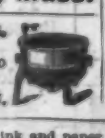

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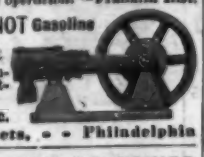

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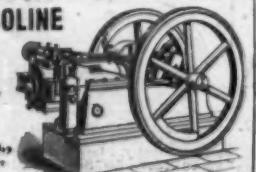

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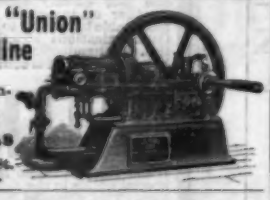

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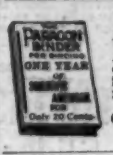

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